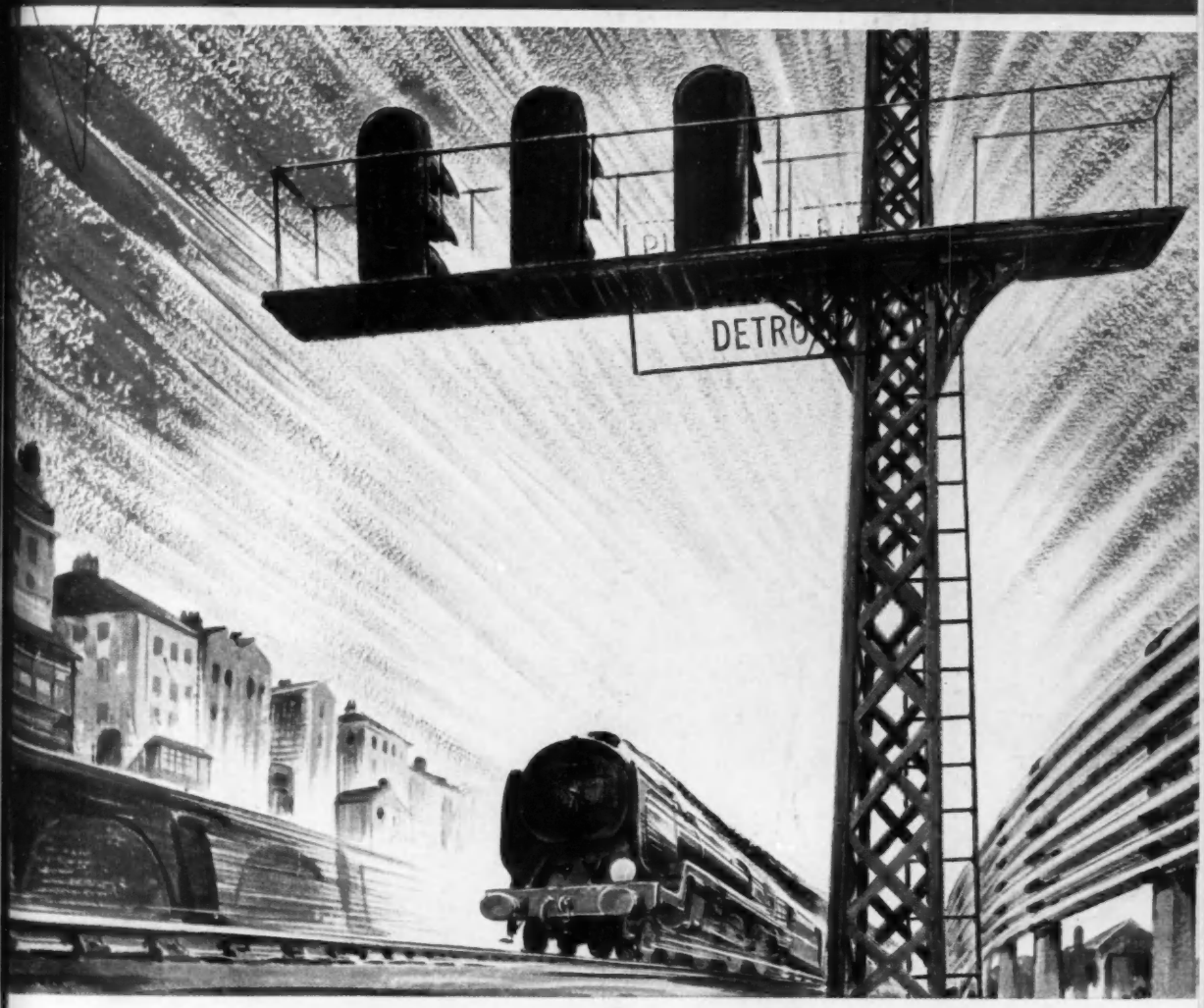
TECHNOLOGY DEPT.

ELECTRICAL REVIEW

FRIDAY
DECEMBER 1958

WEEKLY
PRICE 1s 6d



FOR RAILWAY SIGNALLING CABLES

Paper insulated power cables for working voltages up to 33kV manufactured to British Standard or foreign specifications, with copper or alternatively aluminium conductors.

Mass impregnated non-draining paper insulated lead covered cable.

Cambric insulated cables.

Corrosion resistant P.V.C. sheathed paper insulated lead covered cables.

Multicore cables for railway signalling control and telephone circuits.

Aberdare Cables Limited

ERDARE, GLAMORGAN. ABERDARE 416. LONDON OFFICE: NINETEEN WOBURN PLACE W.C.1. TERMINUS 2777

TGA 53

SPECIFY RIST'S FOR CABLES

RIST'S

In addition to our wide range of cable manufacture, we specialise in the production of cable assemblies, leads and cords

Please write for further details

RIST'S WIRES & CABLES LTD

LOWER MILEHOUSE LANE • NEWCASTLE-UNDER-LYME • STAFFS

Heatrae

of Norwich

Originators of Rectangular cistern type

WATER HEATERS

The F.B. (flat back) Cistern Type, Thermostatically controlled Electric Water Heater, is a complete hot water system in itself. It has its own ball valve feed, expansion pipe and overflow connection. Available from stock in capacities up to 30 gallons. Larger sizes can be made to order.

The Heatrae F.B. Cistern Type is a pioneer Electric Water Heater. It occupies minimum space, has small projection and invariably gives satisfaction.

Please write for sectional leaflet 'DEg'

HEATRAE LIMITED

Pioneers since 1920 in all-electric water heaters

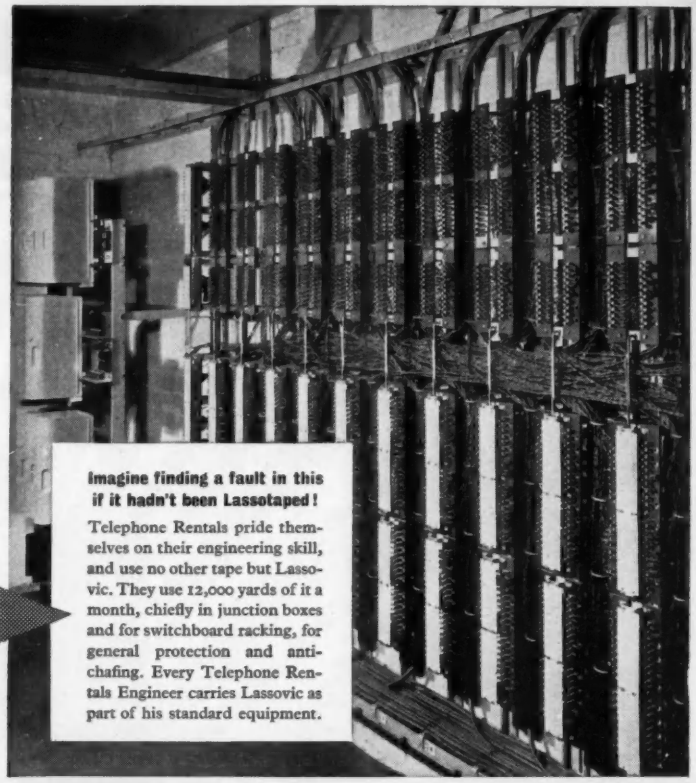
NORWICH - ENGLAND

TELEGRAMS: HEATRAE · NORWICH TELEPHONE: NORWICH 25131 (PRIVATE EXCHANGE)

Manufacturers of Electric Water Heaters, Oil Heaters, Immersion Heaters, Urns, Towel Rails, Airing Cupboard Heaters, Electric Fires, Flameproof Heating Apparatus, Food Trolleys, Warming Plates, Air Heaters. Specialists in Steam Heated Oil Heaters and Calorifiers for Shipboard

A

This is why TELEPHONE RENTALS



Imagine finding a fault in this if it hadn't been Lassotaped!

Telephone Rentals pride themselves on their engineering skill, and use no other tape but Lassovic. They use 12,000 yards of it a month, chiefly in junction boxes and for switchboard racking, for general protection and anti-chafing. Every Telephone Rentals Engineer carries Lassovic as part of his standard equipment.

and MURPHY RADIO

Corrosion is the danger: Lassothene is the answer

Any material that Murphy uses has to pass rigorous type approval tests in their Engineering Dept. They gave Lassothene good marks for high dielectric strength, low water absorption, and chemical purity. Here are components for a portable radio, and TV sets.

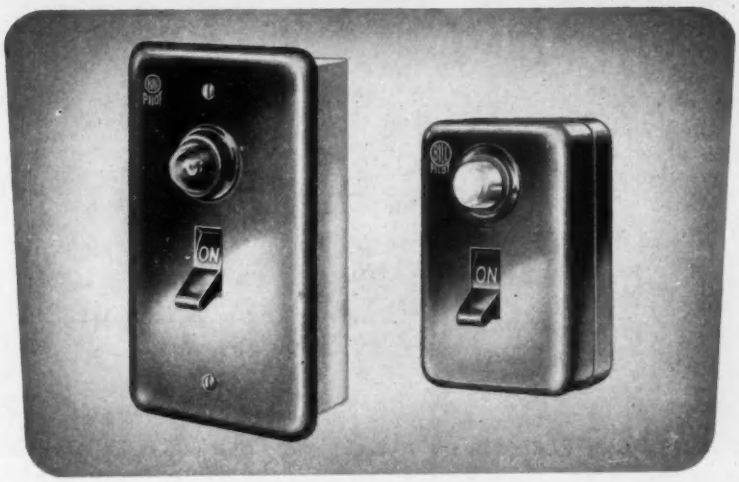
always rely on LASSOTAPES

Advice and information free at any time from

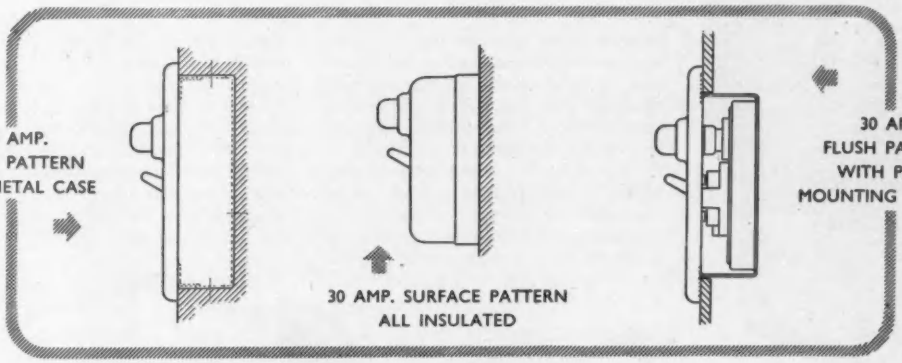
TECHNICAL TAPES DIVISION, H29 SMITH & NEPHEW LTD., WELWYN GARDEN CITY, HERTS

You cannot buy better gear

BILL PILOT SWITCHES



- IDEAL FOR WATER HEATING INSTALLATIONS UP TO 6 K.W. LOADING WHERE ON-LOAD INDICATION IS REQUIRED
- HIGH PERFORMANCE A.C. DOUBLE-POLE, SLOW BREAK SWITCHES WITH SILVER TIPPED CONTACTS
- TERMINALS ARE POSITIONED FOR EASY WIRING WITH FULL PROVISION FOR THROUGH EARTH CONNECTION



BILL SWITCHGEAR LTD.
ASTON LANE · PERRY BARR
BIRMINGHAM·20

LONDON, S.W.1 A. W. ZELLEY, N. PAYNE, GILLINGHAM ST. | MIDLANDS G. H. GARBETT, H. WILLIAMS HEAD OFFICE | NORTH MIDLANDS C. G. BACHELOR HEAD OFFICE | EAST MIDLANDS J. A. PEARCE HEAD OFFICE | CHELTENHAM C. GEARING, HIGH ST. | MANCHESTER 3 H. H. POLLARD, J. H. RAMSAY, F. A. MAYOR, WOOD STREET | BRISTOL, 3 W. L. WHITE, CHURCH LANE | LEEDS, 7 N. SHARPLES, G. SUTTON, LOVELL RD. | GLASGOW J. D. HARRIS, I. J. HARRIS, SANDYFORD PLACE | BELFAST J. BALLENTINE DONEGALL ST.

MEMLO + MEMLITE
a safe light

Manufacturers save on lighting costs and provide increased safety for operators by installing low voltage localized lighting. This lighting is made even more economical by using the "Memlo" low voltage transformer unit. Designed for mounting in convenient positions, where low voltage lighting is desirable, "Memlo" comprises a main D.P. switchfuse, a double wound transformer and fuses for secondary circuit, all enclosed in a neat cast-iron case. Three models are available for use on A.C. supply to step down voltage from 230/250 to 12 or 25 volts, 400/440 to 12 or 25 volts, and 400/440 volts to 25 or 50 volts. "Memlite" adjustable lamp fittings are all supplied with bases available for conduit attachment, "Memlo" attachment, or portable use. Write for full descriptive literature.

Model 2 B.S. attached to "Memlo"

The light industrial pattern "Memlite" illustrated is provided with two arms and a metal reflector, enamelled white inside and grey outside. The shade is supported independently of the lampholder. A standard B.C. all-insulated lampholder is supplied wired with twin flex.

Two arm Heavy Industrial Pattern

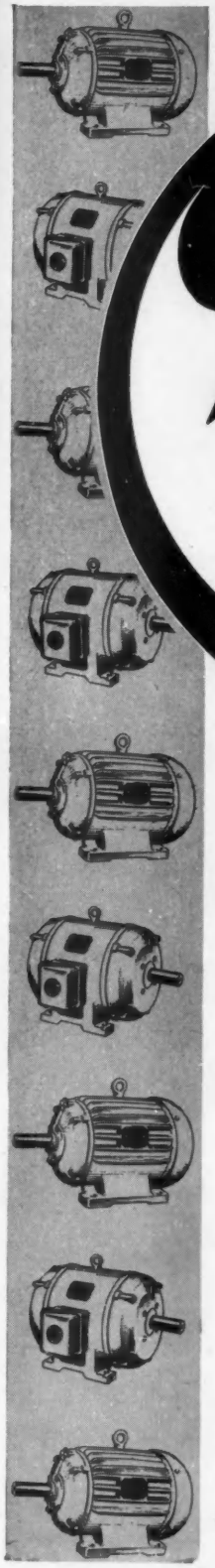
A lamp fitting of high quality and great strength for heavy service. Fittings are supplied complete with all-insulated B.C. lampholders, wired with twin flex. Joints, etc., have special rust-resisting finish.

Three arm Heavy Industrial Pattern

Made on similar lines to the two arm heavy industrial pattern, for those positions where greater extension is required.

MEM

MIDLAND ELECTRIC MANUFACTURING CO. LTD · TYSELEY · BIRMINGHAM 11



B
T-H

for
BRITISH
STANDARD
DIMENSION
INDUCTION MOTORS

Ventilated or T.E.F.C.

DELIVERY FROM STOCK

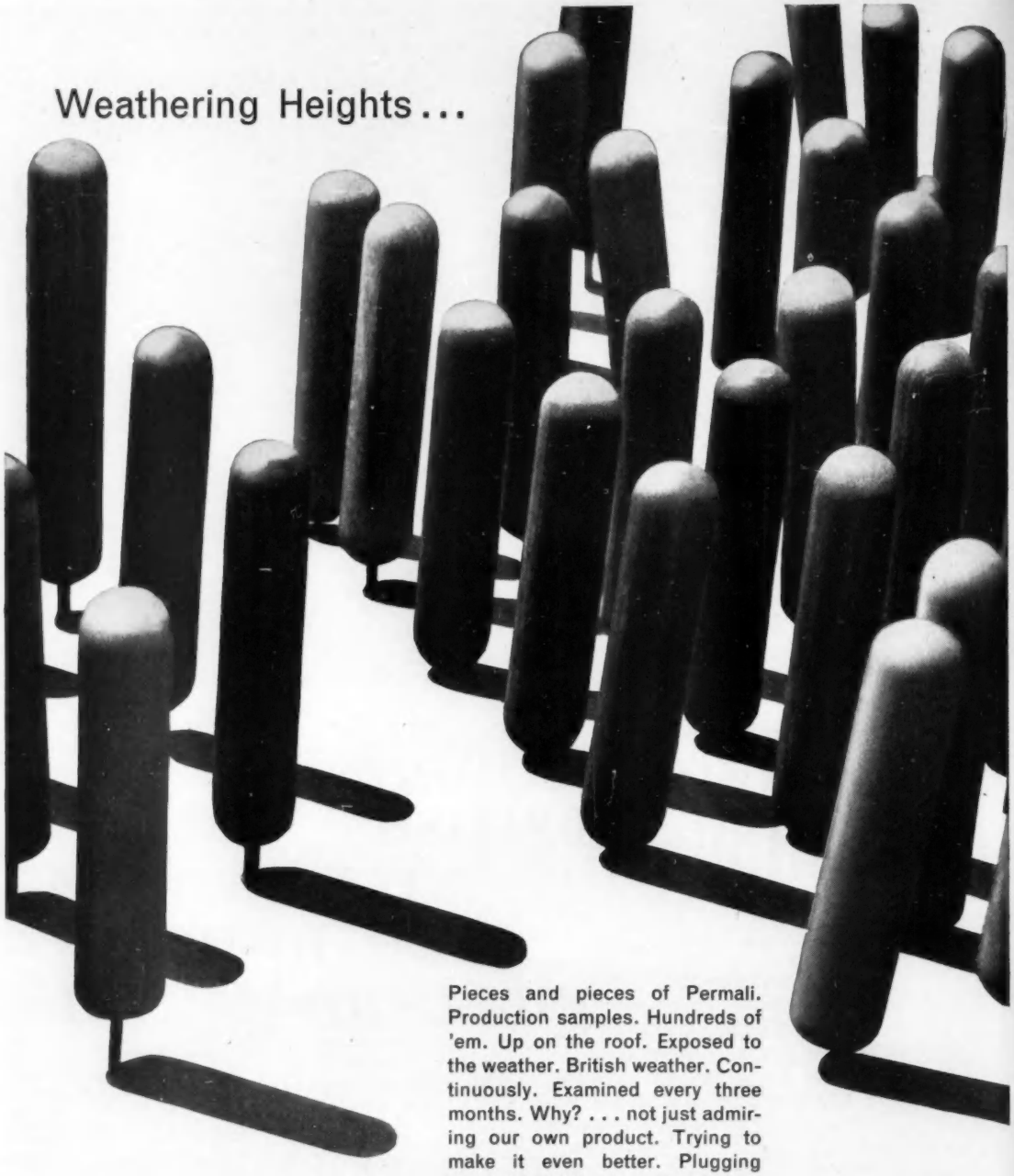
BRITISH THOMSON-HOUSTON

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED · RUGBY · ENGLAND

an A.E.I. Company

A5320

Weathering Heights...



Pieces and pieces of Permali. Production samples. Hundreds of 'em. Up on the roof. Exposed to the weather. British weather. Continuously. Examined every three months. Why? . . . not just admiring our own product. Trying to make it even better. Plugging away at it. All the time. Succeeding too, sometimes.

PERMALI

INSULATION

Totally tested...
...most reliable

PERMALI LIMITED GLOUCESTER ENGLAND TEL: 24941

YORKSHIRE SWITCHGEAR in Australia...

In the Commonwealth of Australia Department of Works and Housing, there is a comprehensive Yorkshire Switchgear indoor installation.

For Australia wants, and gets, the best, to give decades of utterly dependable service in an exacting climate—and in a country where maintenance is expensive. So she ordered Yorkshire Switchgear.

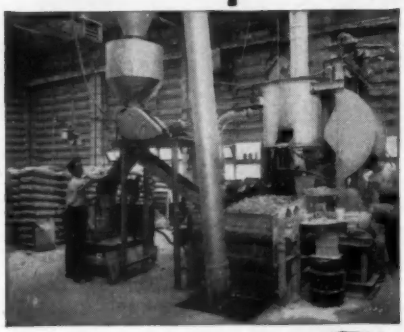
And what's good enough Down Under is good enough anywhere.

Too right, cobber!

YORKSHIRE SWITCHGEAR
& ENGINEERING CO. LTD., MEANWOOD, LEEDS, 6.
TEL: LEEDS 57121-5
London: Grand Buildings, Trafalgar Square, W.C. 2.
Tel: Whitehall 3530.
Also: Electro-Mechanical Manufacturing Co. Ltd., Scarborough

11306

120 HOURS A WEEK Non-stop!



BKS

We specialize in the design and manufacture of automatic sequence control panels and have supplied them to practically every industry.

This control Panel has been designed and built for the sequence control of synthetic resin coated sand processing. The machine operates 5 days a week—day and night—non-stop producing 1½ tons of coated sand every hour. After loading the hoists the Panel automatically controls all process operations including discharge into the sacks. The Floor Mounted Controller incorporates H.R.C. fuses and heavy duty automatic starters for all motors which total 100 horse power. Mounted on the Panel are 6 visible continuously adjustable dial process timers with tamper proof operation counter giving full automatic control of the coating operations with manual control for sampling. This method of automatic control definitely reduces production costs. Scrap caused by incorrect mixing by hand is entirely eliminated and uniformity in batch production constantly maintained.

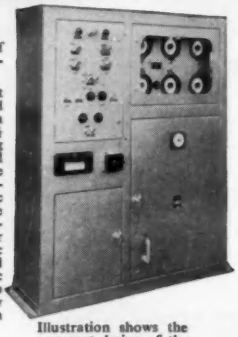


Illustration shows the compact design of the B.K.S. Panel.

May we receive your enquiries—We are confident that our suggestions will save you time and product cost.

SPECIALISTS IN ELECTRICAL CONTROL

Send for our catalogue illustrating special panels and complete range of Standard Motor Control equipment.

BRITISH KLOCKNER SWITCHGEAR LTD.

HEAD OFFICE AND WORKS : **CHERTSEY, SURREY**

Telephone : Chertsey 3467

LONDON : Refer to Head Office
MANCHESTER : Cromford House, Cromford Court, Manchester 4 Tel : BLAckfriars 3903
GLASGOW : 249 St. Vincent Street, Glasgow, C.2. Tel : CENtral 2479
NEWCASTLE : Mr. H. Breeze, 4 Beechwood Avenue, Monkseaton, Whitley Bay, Northumberland. Tel: Whitley Bay 24231
BIRMINGHAM : 2-3 Graham Street, Birmingham 1. Tel: Central 6693
DUBLIN : Mr. H. E. Kilbride-Jones, 11 Crow Street, Dublin. Tel: Dublin 71717

Post this coupon TODAY

To BRITISH KLOCKNER SWITCHGEAR LTD., CHERTSEY, SURREY
Please send me your latest comprehensive catalogue

NAME .....
POSITION .....
FIRM .....
ADDRESS .....

ER/12/58

They've got to be good to be *there*

Photography by courtesy of ***SANTON LTD***

Otter

THERMOSTATS

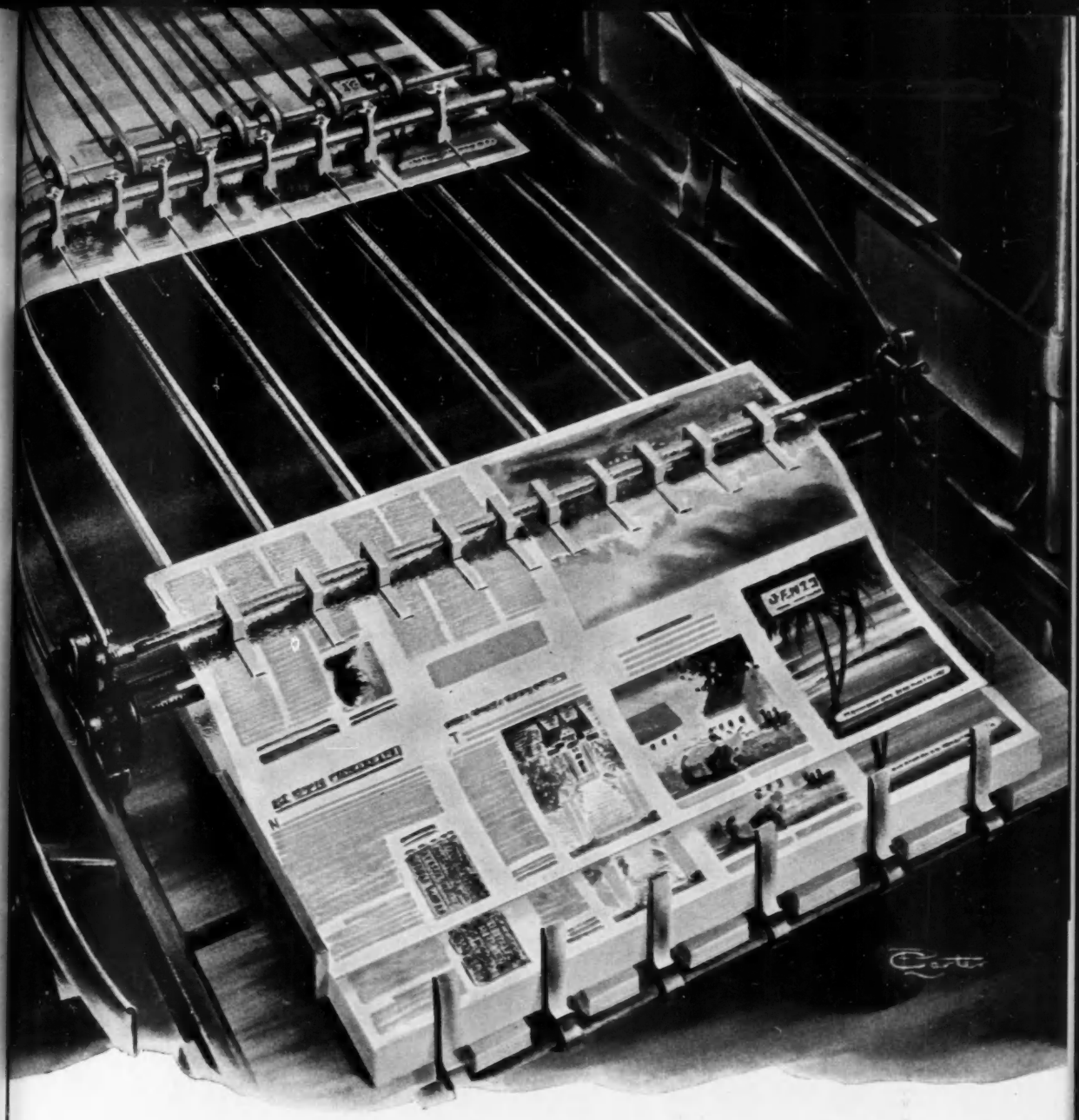
The SIMPLEST and most RELIABLE of all safety switches

Otters press their contacts together to open them with a "SNAP"

OTTER CONTROLS LTD

Otters 'ole, Market Street, Buxton, Derbyshire

Phone: Buxton 650 (2 lines)



N PRINTING,

s in every sphere of industry, Metropolitan-Vickers are in the forefront f electrical progress. Many advances in the design of drives and ontrols for printing machinery owe their origin to the research, nterprise and experience of this great organisation.

METROPOLITAN-VICKERS

ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

A/A

An A.E.I. Company

G.E.C.

switchgear

MW Range *for general industrial application*
HW Range *for heavy industry*
DW Range *for domestic installation*

THE GENERAL ELECTRIC CO. LTD
MAGNET HOUSE · KINGSWAY · LONDON WC2

end for
3730, a
ze guide
lection
artridge

G.E.C.

H.R.C.

fuse links

A.S.T.A. certified

stocked at all G.E.C. branches

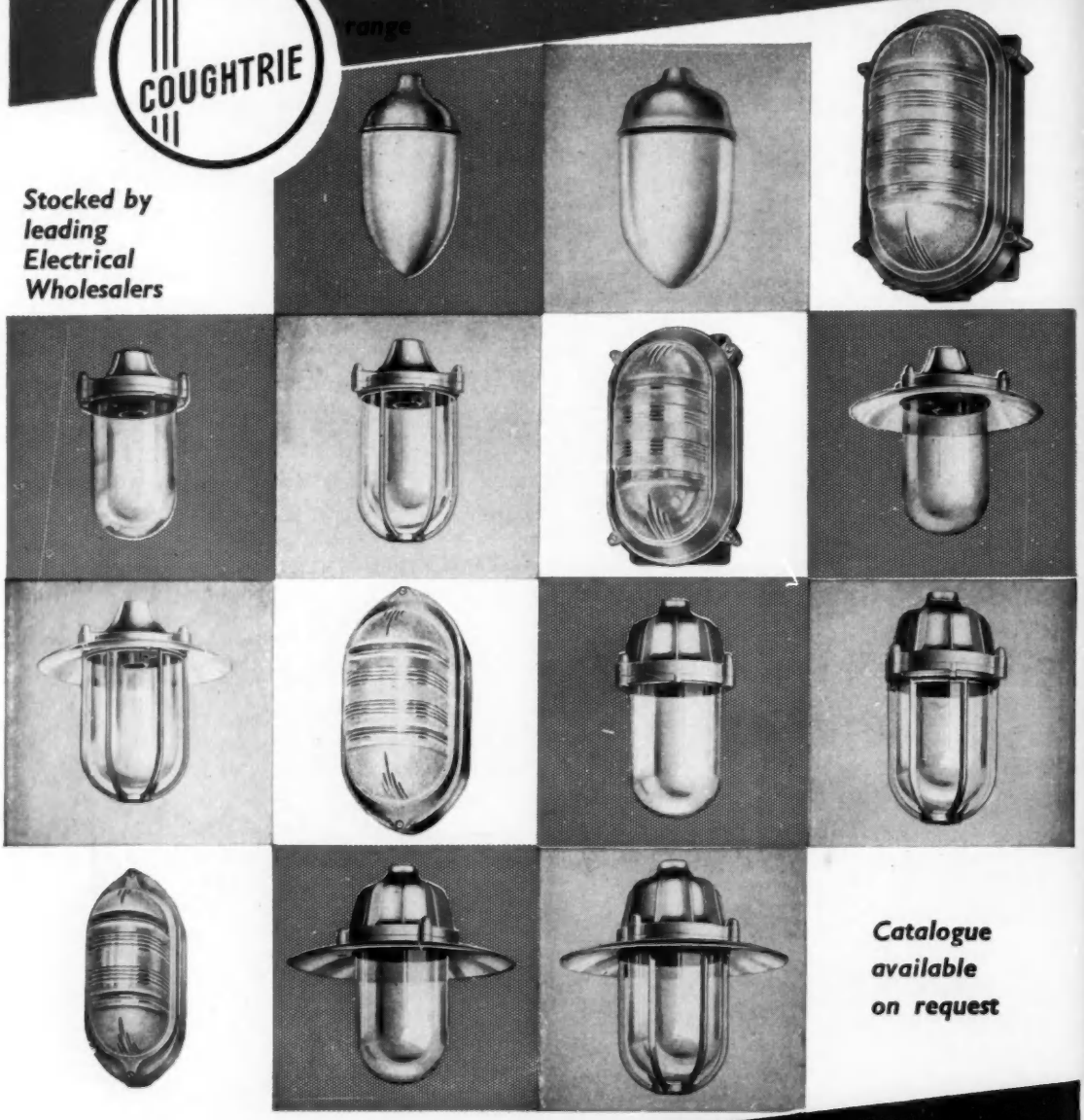
end for Publication
3730, a handy pocket-
ze guide to the
lection of Industrial
artridge Fuses

A FITTING Contribution to Industry

Examples of the range

COUGHTRIE

Stocked by leading Electrical Wholesalers



Catalogue available on request

Manufactured by

J. & G. COUGHTRIE LTD.

at Hillington, Glasgow, S.W.2.

WESTINGHOUSE

EXPERIENCE

is your Guarantee for all Rectifier problems

1931 *Copper-oxide rectifiers charging bus batteries for Southampton Corporation.*

1958 *One of the twenty-five Westinghouse automatic universal taper chargers installed at Leith for the maintenance of batteries fitted to inter-city diesel railcars operating between Glasgow and Edinburgh.*

WESTINGHOUSE BRAKE AND SIGNAL CO. LTD., 82 YORK WAY, KING'S CROSS, LONDON, N.1

Telephone: TERminus 6432

THE efe NEW 13 AMP

2 WAY ADAPTOR

Compact & Competitive

efe

Brown
No. 1300
Ivory White
No. 1302
Ruby
No. 1307

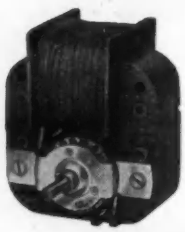
ASK FOR DETAILS

ACTUAL SIZE
Only 1⅞" × 1¾" × 1½"

E. F. ELECTRIC LTD. WILLOW LANE · WATFORD · HERTS
Telephone: WATFORD 26878 · WATFORD 32616 *Telegrams & Cables:* E.F.E. WATFORD

ROLCO

SHADED POLE FRACTIONAL H.P. ELECTRIC MOTOR



Reliable, Silent and Versatile Power Unit for every kind of equipment.

Standard Types from 25va. to 80va. or to Customers' Specification.

Manufactured by

ROLCO ENGINEERING LTD.
407 Hornsey Road, London, N.19
Tel: ARC 6626

LEONARD HEYS BLACKPOOL

for EVERYTHING ELECTRICAL by the best makers

(WHOLESALE ONLY)

Prompt and personal attention. Deliveries throughout LANCASHIRE by our own vans (elsewhere by B.R.S.)

CMA and other CABLES; MEM SWITCHGEAR; CONDUIT and all WIRING SUPPLIES; FHP MOTORS; LIGHTING, HEATING and DOMESTIC APPLIANCES; BLACK & DECKER and BRIDGES ELECTRIC TOOLS, etc.

We carry good stocks; enquiries welcomed.

LEONARD HEYS LTD. *(Elec rical Division)*
CASTLEGATE, LYTHAM ROAD, BLACKPOOL.
Phone 28364. Grams: HEYS BLACKPOOL (TELEX). Telex No. 67-636.

COLD METAL PRESSINGS MANUFACTURERS

1,000 amps.

Write for prices and illustrated list.

COPPER TUBULAR CABLE SOCKETS

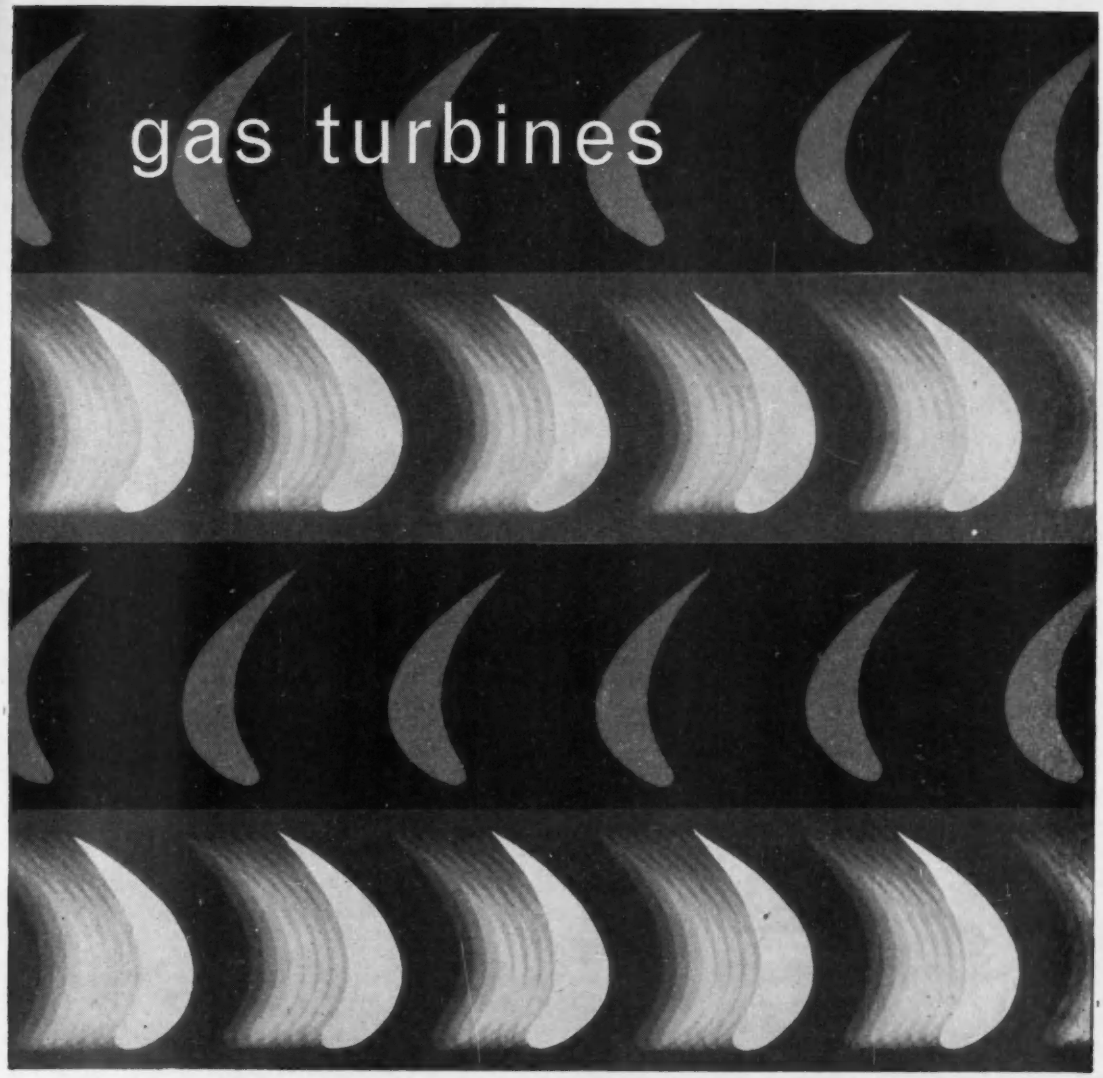
15 amps.

DIPPED TINNED

B.S.I. Type No. 91–1930 No. 91–1954 X.L. Light Type

EXCELALL METAL WORKERS LTD.

Phone: Victoria 0297 BIRMINGHAM 11 *Grams:* "Superpress"



We build gas turbines of Brown Boveri design—the range of outputs being from 2500 kW to 30,000 kW—fired by gas or oil. A 2500 kW generating set recently built for Shelton Iron and Steel Ltd. runs on blast-furnace gas, gas-oil or a mixture of the two. Since we are also builders of steam turbines, alternators, centrifugal and axial flow blowers of Brown Boveri design, water-tube boilers of Foster Wheeler design, shell boilers, condensers, feed-water heaters, and rotary water strainers, we are particularly well able to design and carry-out schemes of any size for the efficient use of any available fuel.

Richardsons Westgarth (HARTLEPOOL) Ltd

R W G

A member of the RICHARDSONS WESTGARTH GROUP which co-ordinates the land and marine activities of:

THE NORTH EASTERN MARINE ENGINEERING CO. LTD.
PARSONS MARINE TURBINE CO. LTD.
GEORGE CLARK & NORTH EASTERN MARINE (SUNDERLAND) LTD.
RICHARDSONS WESTGARTH (HARTLEPOOL) LTD.
THE HUMBER GRAVING DOCK & ENGINEERING CO. LTD.
RICHARDSONS WESTGARTH ATOMIC LTD.

ASSOCIATED COMPANY: ATOMIC POWER CONSTRUCTIONS LTD.

RICHARDSONS WESTGARTH (HARTLEPOOL) LTD. HARTLEPOOL, CO. DURHAM
and at 58 Victoria Street, London, S.W.1 • 59 Mosley Street, Manchester, 2 • 75 Buchanan Street, Glasgow, C.1

HEAVY DUTY PATENT 'T.A.'

This patent bayonet holder will operate continuously at 10 amps with safety, and will reduce maintenance charges. Specially designed for Railway conditions.

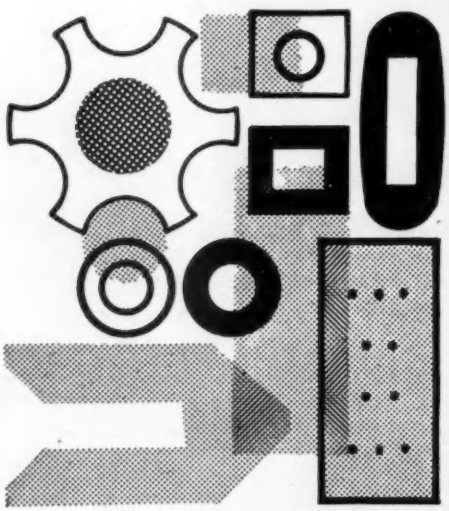
LAMPHOLDER

SPERRYN

SPERRYN & CO. LTD., MOORSOM ST., BIRMINGHAM 6

Telephone: ASTon Cross 4011 (5 lines)

LONDON ADDRESS: 23 GREAT SUFFOLK ST., LONDON, S.E.1 TELEPHONE: WATERLOO 6418



The shapes of precision Electrical Insulation . . .

Mica and other insulating components

We are manufacturers of essential Insulation Parts, to the Electrical Industry over an extensive field both at home and overseas. A wide range of Mica, bonded resin and Micanite Processed Parts, punched, cut, split and gauged to precise specifications are produced speedily and with the utmost accuracy. A large section of our resources is devoted to the production of heating element insulating parts, stove plates, water level gauge glasses, compass cards and washers. Enquiries relating to all markets are welcomed.

DACIER Ltd

22 BARGATES · CHRISTCHURCH · HANTS · ENGLAND

Tel: Christchurch 1011

Buy NIFE Lamps now for years of light

NIFE PORTABLE LAMPS are powered by all-steel alkaline batteries which won't corrode or self-discharge. You can leave a Nife lamp standing idle for months or even years—and it will work the first time you touch the switch. Nife lamps are lighting the way for public works engineers, railway engineers, fire brigades, civil engineers, oil companies and hospitals . . . down mines, aboard ship and in every branch of industry.

NIFE SEARCHLIGHT S6

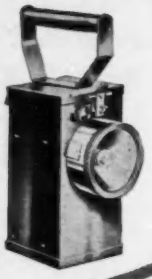
Gives 3 hours' light on 3.0 amp. main filament or 20 hours on reserve filament. The beam of light equals that of a motor car headlamp. Approved by the Ministry of Fuel & Power.

NIFE HEADLAMP NC113C

Gives 10 hours' light on main high efficiency 1.0 amp. Krypton gas-filled bulb. Fitted with pilot bulb for emergency. Approved by the Ministry of Fuel & Power and Ministry of Transport.

NIFE HANDLAMP NH10A

Sturdy all-purpose inspection lamp weighing only 4 lb. Gives approximately 10 hours' light per charge. Approved by the Ministry of Fuel & Power and Ministry of Transport.

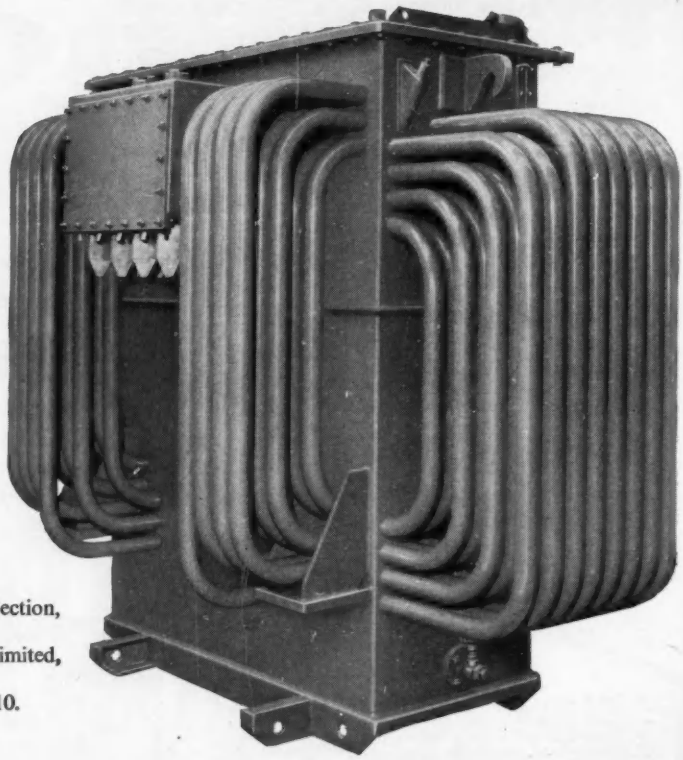


✻ **ILLUSTRATED LEAFLETS** about these and other Nife lamps will be gladly sent on request to: Nife Batteries, Redditch, Worcestershire.

NIFE *batteries won't corrode* N.120

Distribution transformers for the world's needs

- *Pole mounting*
- *Platform mounting*
- *Ground mounting*
- *Oil filled*
- *Inert fluid filled*
- *Dry type*



Send your enquiries to:

Transformer Sales & Contracts Section,

The ENGLISH ELECTRIC Company Limited,

East Lancashire Road, Liverpool, 10.

'ENGLISH ELECTRIC' transformers

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2

Transformer Department, Liverpool

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

TFL.29A

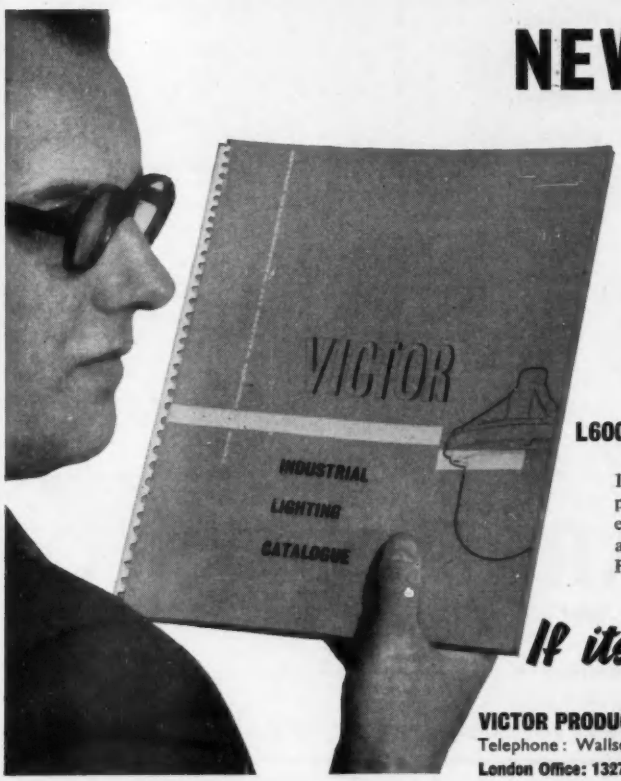
WOOTTON
METER BOARDS

carry a load of responsibility and never let you down

and don't forget
WOOTTON wood blocks
sunk switch boxes
instrument cases

"You're never 'in a fix' if you fix Wootton Meter Boards—just the job for durable, reliable functioning under all climatic conditions. Yes sir!—they're as tough as you can make 'em!"

WOOTTON & CO. LTD. · ALMA WORKS · PONDERS END · MIDDLESEX · *Telephone: Howard 1858*



NEW *Enlarged*
VICTOR LIGHTING CATALOGUE

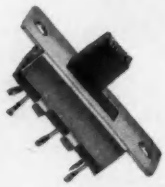
L600 is now available *FREE* on request

It covers the unique Victor range of certified Weatherproof—Flameproof Lighting Fittings, Junction Boxes etc., for hazardous, exposed, unprotected applications and also the complete range of Flameproof and Non-Flameproof Fittings.

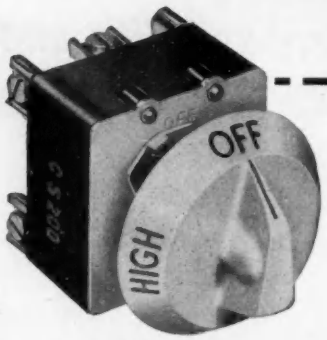
If its lighting—its Victor!

VICTOR PRODUCTS (Wallsend) LTD. Wallsend-on-Tyne · England
Telephone: Wallsend 68331 Telegrams: 'Victor' Wallsend
London Office: 1327 LONDON RD., NORBURY, S.W.16 Tel.: POLlards 0077 (3 lines)

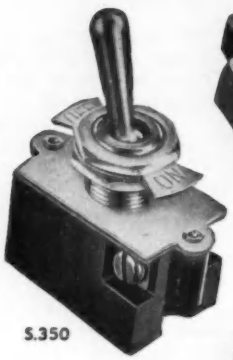
Arcolectric Switches



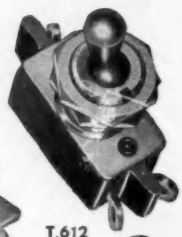
T.225



C.S.200

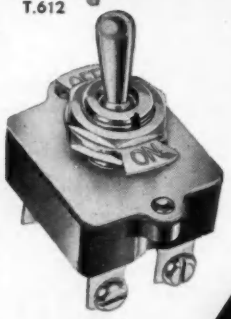


S.350



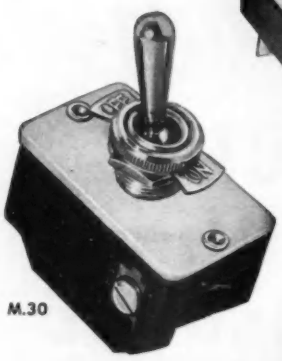
T.612

T.280

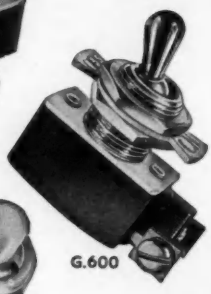


S.254

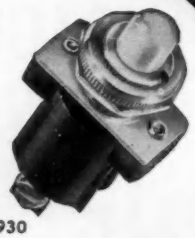
S.254	10-AMP Double pole
C.S.200	15-AMP Rotary Cooker Switch (Double pole 3 "heat" and "off")
T.280	Sensitive Snap Action Switch
T.612	3-AMP single pole change-over
S.350	5-AMP Toggle Switch
T.225	1-AMP Miniature Slide Switch
M.30	10-AMP Toggle Switch
G.600	3-AMP Toggle Switch
S.930	Door Switch for refrigerators
T.620	3-AMP double pole



M.30

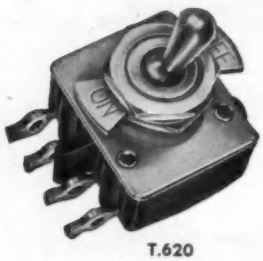


G.600



S.930

Write for Catalogue No. 131



T.620

ARCOLECTRIC SWITCHES · LTD

CENTRAL AVENUE · WEST MOLESEY · SURREY · Tel.: MOLESEY 4336

Du Pont's 2 Chemical Rubbers—
Neoprene and Hypalon—are at your service

For extra durability and value to guarantee customer satisfaction with your rubber products, try Du Pont's neoprene and HYPALON.

Neoprene has high resistance to most causes of deterioration and will withstand rugged conditions. HYPALON has extra high ozone resistance; high colour stability; withstands high temperatures. Your distributor will gladly give you further information. Send coupon for "Du Pont Elastomers Notebook", showing new ways elastomers save money.

For more information about locally manufactured products made of Du Pont neoprene and Hypalon, write:

Distributors DU PONT COMPANY (UNITED KINGDOM) LTD.,
76 JERMYN STREET, LONDON, S.W.1
Sales Agents DURHAM RAW MATERIALS LTD.,
131 GREAT TOWER STREET, LONDON, E.C.3

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living . . . through Chemistry

E. I. Du Pont de Nemours & Co. (Inc.)
St. Johannsvorstadt 80,
Room 120,
Basle 4, Switzerland.

NAME.....

POSITION.....

COMPANY.....

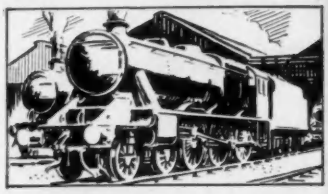
ADDRESS.....

CITY..... COUNTRY.....

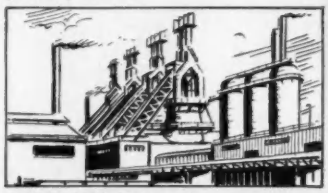
B

PRACTICAL TESTS HAVE PROVED THAT
NO CONDITIONS ARE TOO SEVERE
FOR REAL "REFLECTORTIGHT"
NON-CORRODIBLE FITTINGS

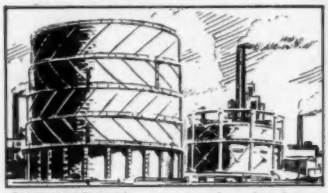
THERE is a rapidly growing demand for 'Reflectortight' Fittings from almost every industry—particularly where severe atmospheric conditions obtain. The 'Reflectortight' range of Dispersive and High Bay Mounting fittings caters for lamps from 100 to 500 watt size. May we send you further particulars?



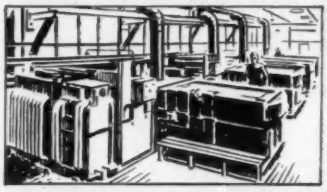
LOCOMOTIVE SHEDS "installed over a railway turntable . . . not been attacked in any way by the corrosive fumes . . . interior of the reflectors perfectly clean."



STEEL WORKS "Reflectortight fitted in Sulphate House — no noticeable corrosion, reflector found to be in perfect condition."



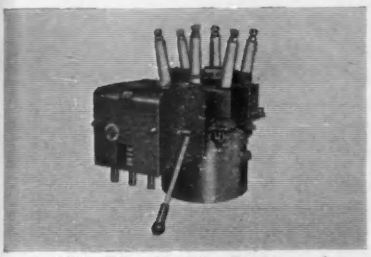
GAS WORKS . . . "used under heavy fine coke dust conditions, the temperature is 180°F continuous and intermittent . . . Reflectortight giving good service."



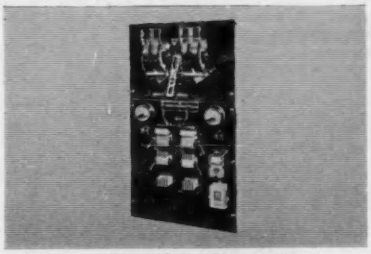
ELECTRO PLATING WORKS "We would say that in our opinion it is a fitting ideally suitable for the corrosive atmosphere of a Plating Shop."

REAL
"REFLECTORTIGHT"

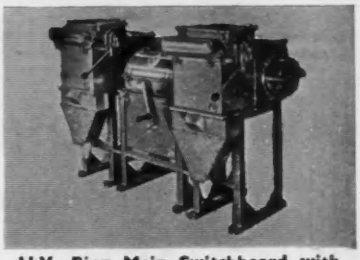
R.E.A.L. *is the registered trade mark of*
ROWLANDS ELECTRICAL ACCESSORIES LTD., R.E.A.L. WORKS, BIRMINGHAM 18



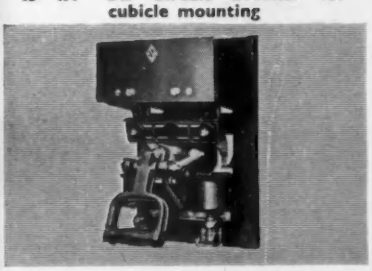
15 kV Oil Circuit Breaker for cubicle mounting



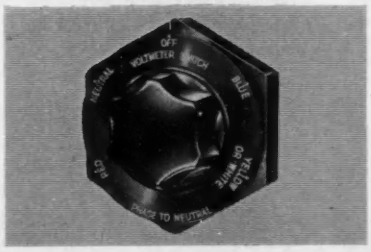
Heavy Current D.C. Circuit Breaker and Knife Switch Panel



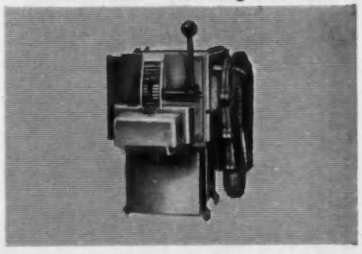
H.V. Ring Main Switchboard with Fuse Switch controlling Tee-Off



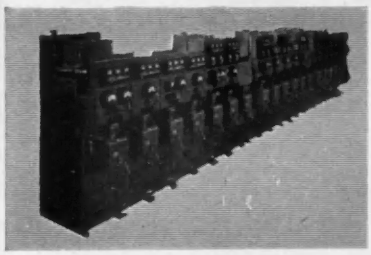
Small Air Circuit Breaker



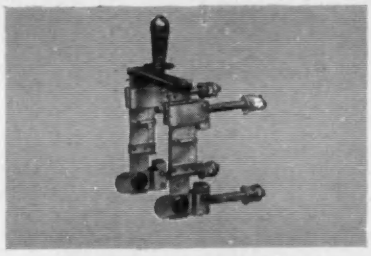
Ammeter and Voltmeter Switches



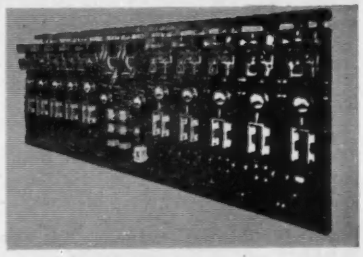
L.V. Industrial Oil Circuit Breaker



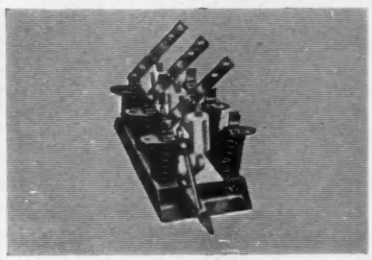
11 kV Metalclad Switchboard



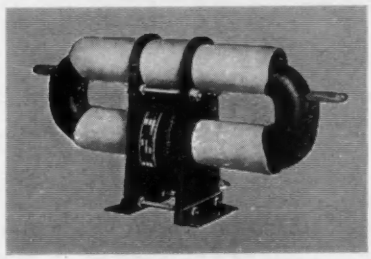
Panel Mounting Knife Switch



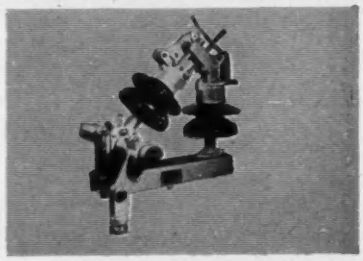
D.C. Switchboard for Steel Works



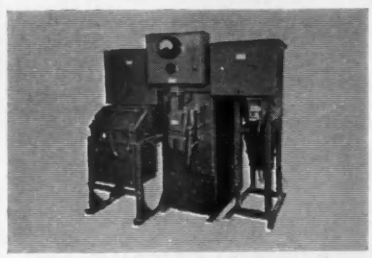
T.P. 11 kV Isolating Switch



Current Transformers



Outdoor Pole Mounting Isolators



H.V. Switchboard incorporating Automatic Fuse Switch

STATTER

Specialists in Switchgear for over 50 Years

Industrial Switchboard with Drawout Oil Circuit Breakers

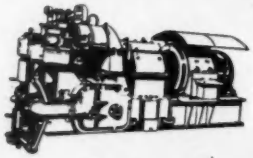
J. G. STATTER & CO. LTD

82 VICTORIA ST. LONDON SWI

Members of Lancashire Dynamo Group

BROTHERHOOD

GENERATING SETS



Turbine driven up to 11,000 kW. Engine driven up to 340 kW.

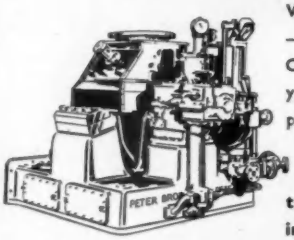
Many in hand, hundreds in service.

BROTHERHOOD

VERTICAL AND HORIZONTAL

STEAM TURBINES

FOR DRIVING PUMPS, ETC.



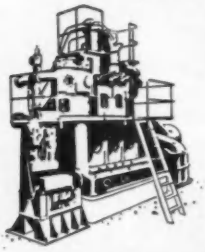
Wide range — All types. Over 50 years experience.

Scores in hand— thousands in service.

BROTHERHOOD

VERTICAL AND HORIZONTAL

COMPRESSORS



Air, Gas and Refrigerating.

The widest range in the British Empire — made to suit your requirements.

Thousands in service.

Also Manufacturers of all kinds of

PLANT TO CUSTOMERS' OWN DESIGNS

WHY NOT SEND YOUR PROBLEMS TO US

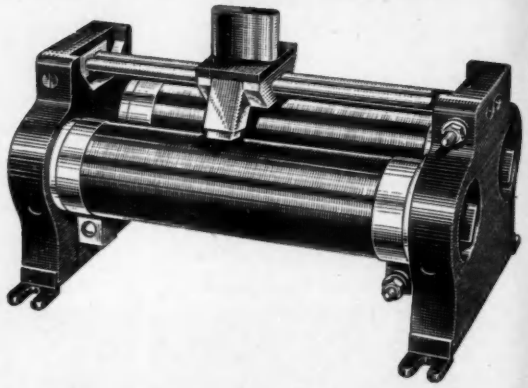
PETER BROTHERHOOD
PETERBOROUGH · ENGLAND
COMPRESSOR & POWER PLANT SPECIALISTS FOR NEARLY A CENTURY

P.1558

Consult Birch

REGISTERED TRADE MARK

for TUBULAR SLIDING and FIXED RESISTORS



Tubular Sliding and Fixed Resistors. Winding Oxidised Nickel Copper Wire to B.S.115. Brushgear: laminated phosphor bronze brushes or copper graphite brushes in brass die-cast holders. Finish: metal parts heavily nickel plated.

Write for list No 110.

Asbestos Woven Resistor Nets	Heating Elements
Battery Charging Resistors	Loading Resistors
Cartridge Heaters	Motor Operated Resistors
Cubicle Heaters	Resistor Units
Dimming Resistors	Stud Type Resistors
Porcelain and Mica Wound Resistors	Sliding Resistors
	Strip Heaters Metal Cased
	Toroidal Resistors

VITREOUS ENAMELLED RESISTORS

Ferrule or wire end type. Full range of 24 sizes — 1½ — 250 watts. List V.E. 190.

Birch

REGISTERED TRADE MARK

H. A. BIRCH & CO. LTD.

WOOD STREET, WILLENHALL, STAFFORDSHIRE

Telephone WILLENHALL 494 · 495 · Grams WILOHM WILLENHALL

LONDON OFFICE: 1-5 NORTHOLT ROAD, HARROW, MIDDLESEX

Telephone: BYRON 5120

Architect: Gordon Jeeves, F.R.I.B.A.
Consulting Engineers: Winton, Thorpe, Tunnadine & Partners.

Main Contractor: Taylor Woodrow Construction Ltd.
Electrical Contractors: Troughton & Young Ltd.

The Greenwood Airvac Underfloor Conduit System is installed throughout Grosvenor House Extension carrying services to every room. They include television, telephones, power, lighting and signals. Each group is segregated by the Greenwood Airvac Crossover unit fitted in each junction box.

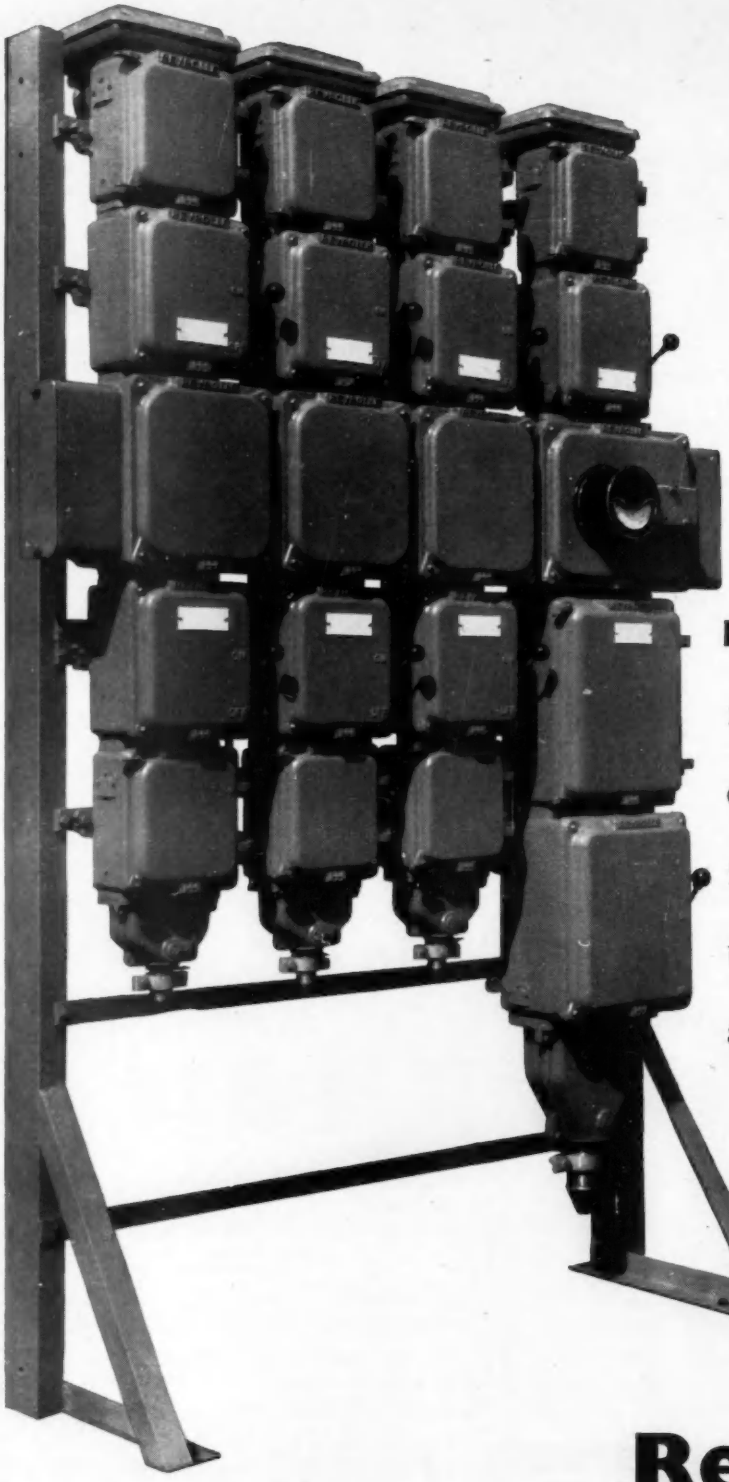
If you would like more details of Greenwood Airvac Conduit Systems, call to see the demonstration layout at Carlisle House or write to us.

We'll be glad to send full information.

Greenwood Airvac Conduits Ltd

Patentees, Designers and Manufacturers of Electrical Conduit Systems

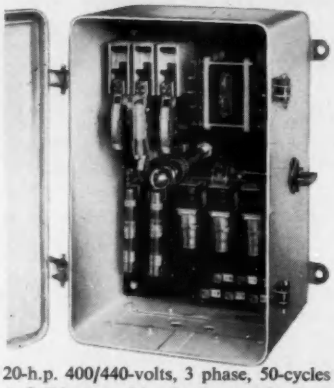
CARLISLE HOUSE, 8 SOUTHAMPTON ROW, LONDON, W.C.1. CHAncery 9377 (3 lines) 'Grams: Aircon, Westcent, London



H unit-construction
metalclad
distribution-gear
for installations
up to 1600 amperes
at 660 volts A.C.

Reyrolle

A. REYROLLE & COMPANY LIMITED · HEBBURN · CO. DURHAM



20-h.p. 400/440-volts, 3 phase, 50-cycles A.C. Direct-on-Line Starter to American Bureau of Shipping requirements.

A.C.

Automatic starters for squirrel cage and slipring motors.

Direct-on-Line (including Starters for reversing and multi-speed motors).

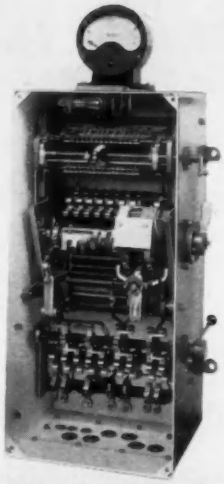
Automatic Star Delta.

Automatic Stator Rotor.

MOTOR CONTROL GEAR FOR MARINE SERVICE

TO BS.587/57 AND LLOYDS OR SIMILAR REQUIREMENTS INCLUDING OWNERS' SPECIFICATION

7½-h.p. 220-volt D.C. Automatic 2-step Starter.



25-h.p. 220-volt D.C. Hand Operated Starter and Regulator.

D.C.

Hand or Automatic Starters for constant or variable speed motors.

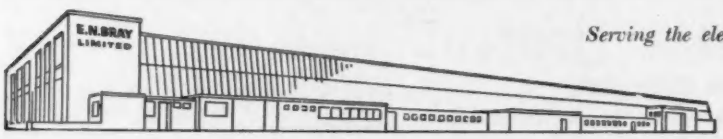
Also, Industrial Control Gear, Contactors, and Relays, etc.

VISIT US ON STAND Y 7
A.S.E.E. EXHIBITION,
EARLS COURT,
MARCH 17th—21st

E. N. BRAY LIMITED

Control Gear Works, Britannia Road, Waltham Cross, Herts. Telephone: Waltham Cross 2212/3/4/5

Serving the electrical industry for more than 30 years



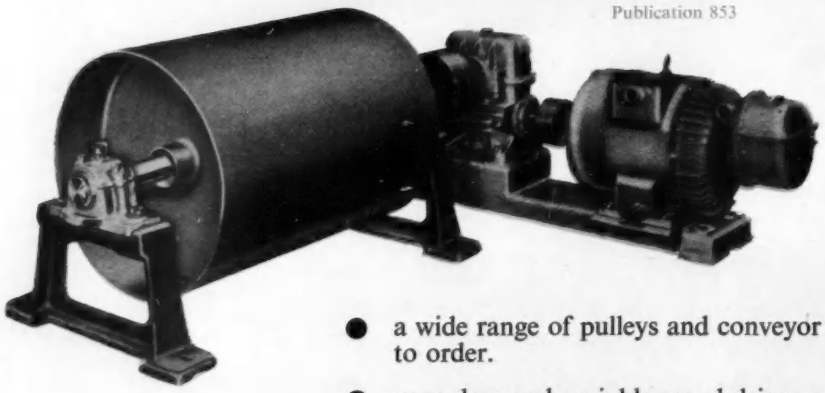
conv
dr

CROFTS MAKE THE

CROFTS CONVEYOR DRIVE ASSEMBLIES

for every possible application

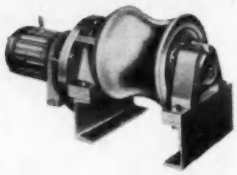
Publication 853



- a wide range of pulleys and conveyor belt drives built to order.
- very slow and variable speed drives a speciality.
- "live" or "dead" shaft pulleys and idlers.

Plummer Blocks plain, ball or roller bearings

Publication 5734



Motor Rollers

Publication 5414

Motorised Conveyor Pulleys

Publication 5745

CROFTS (ENGINEERS) LIMITED

POWER TRANSMISSION ENGINEERS

Head Office: Thornbury Bradford 3 Yorkshire

Telephone: 65231 (20 lines) Telegrams: "Crofters Bradford Telex" Telex 51186

Branches at:

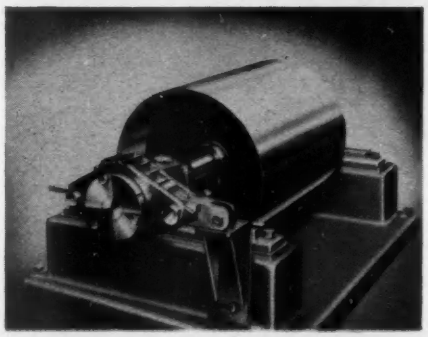
Belfast Birmingham Bristol Cardiff Dublin Glasgow Ipswich Leeds Liverpool London Manchester Newcastle Northampton Nottingham Sheffield Stoke-on-Trent

REPRESENTED THROUGHOUT THE WORLD

eyor ives

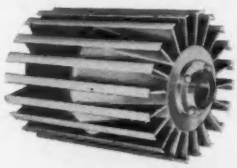
FINEST YOU CAN BUY

CROFTS SILENT RATCHET BACKSTOPS FOR BELT CONVEYORS



POSITIVE PROTECTION AGAINST RUN-BACK DUE TO OVERLOAD OR POWER FAILURE.

six sizes for torques up to 250,000 inch pounds.



Belt Save Conveyor Pulleys

Publication 5715

Cast Iron Conveyor Pulleys

Publication 5416

Shaft Mounted Gear Units

Publication 157

Makers of:

Clutches, Conveyor drives, Couplings of all types, Double helical gear units, Fabricated steelwork, Geared motors, Hydraulic couplings, Iron, steel and non-ferrous castings, Machine-cut gears of all types, Motorised rollers, Patent Taper-flushbushes, Plummer blocks, Shaft-mounted gear units, Special machinery drives, Spiral bevel gear units, Turbine gears, V-rope Drives, Variable speed drives, Worm reduction gears.

CROFTS (ENGINEERS) LIMITED

POWER TRANSMISSION ENGINEERS

Head Office: Thornbury Bradford 3 Yorkshire

Telephone: 63251 (20 lines) Telegrams: "Crofters Bradford Telex" Telex 51186

C-Type
cable markers

- ★ Specially designed for use in conjunction with solderless terminals.
- ★ Can be fitted **after** the terminal is fixed.
- ★ Pressure with the thumb snaps them into position.
- ★ Markings in all figures and letters are available.
- ★ Six sizes cover all cable diameters from ·130" to ·330".

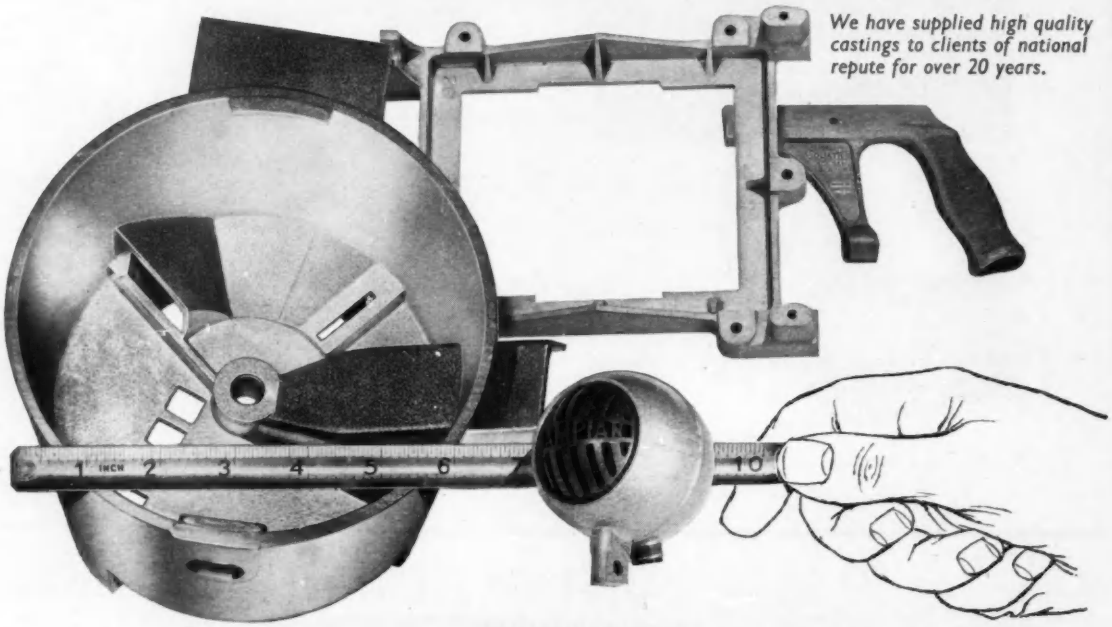
SEND FOR DETAILED LIST

Critchley Bros Ltd

BRIMSCOMBE STROUD GLOS
TELEPHONE BRIMSCOMBE 2208/9

1880

RELIABILITY FROM START TO FINISH



We have supplied high quality castings to clients of national repute for over 20 years.

RAWLINGS *manufacturing company limited*

106-108 BEDFORD HILL, BALHAM, LONDON, S.W.12

PEGASUS ACHIEVEMENTS: No. 5 OF A SERIES

The Ferranti

pegasus

COMPUTER is FULLY DOCUMENTED

Programming Manual

Programming Exercises and Answers (3 volumes)

Specifications of standard Library programmes (2 volumes)

Full details of standard Library programmes

Descriptions of complete programmes (40 documents)

Descriptions of programming techniques (30 documents)

Descriptions of the equipment (20 documents)

Engineers' maintenance manuals (10 volumes)

Indexes are available summarizing: the documents,
the Library programmes,
other programmes.

Enquire for these from:

FERRANTI LTD

FERRANTI

WEST GORTON · MANCHESTER 12
Telephone: EASt 1301
London Computer Centre: 21 Portland Place, W.1
Telephone: LANgham 9211

DC63

MONMORE CONDUITS

The Finest Quality no matter where you look . . .

speedy delivery too !

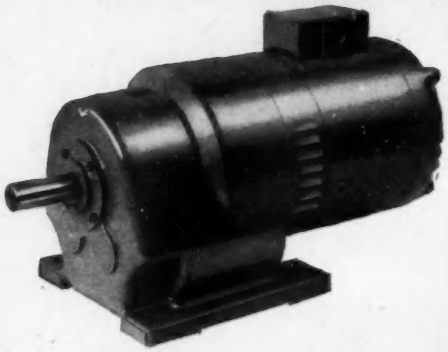
IN DUCTILE STEELS GROUP

MONMORE CONDUITS LTD

WOLVERHAMPTON *Telephone : 27091 (5 lines)*

co-axial geared motors

NECO co-axial geared motors have one-piece cast-iron gearboxes with oil immersed spur gears running on rigidly supported shafts. Gearboxes can be manufactured for foot or flange mounting in any one position.



TYPE DS GEARED MOTOR

1/6, 1/4, 1/3 and 1/2 H.P. motors, 3 phase, single phase and D.C. supplies. Final shaft speeds from 26 r.p.m. to 475 r.p.m. Speeds down to 0.5 r.p.m. with maximum output torque of 100 lb.-ft. are available.

TYPE 25

1/8 h.p. motor, 3 phase, single phase or D.C., final shaft speeds between 312 r.p.m. and 0.079 r.p.m. Maximum output torque is 25 lb.-ft. below 26 r.p.m.

TYPE HD

Up to 3 h.p. transmitted at final shaft from 26 r.p.m. to 480 r.p.m. with maximum output torque of 200 lb.-ft. 3 phase, single phase and D.C. supplies.

NECO TRADE MARK

geared motors

NECO GEARED MOTORS LTD

204 QUEENSTOWN ROAD · LONDON · S.W.8
Telephone: MACaulay 3211-4

Subsidiary of Normand Electrical Company Limited

COMBINATION INSULATION

by Delanco REGD.

IT'S RIGHT HERE

To meet the growing demand for a better slot insulation, the **DELANCO** organisation have developed a composite material combining the highest mechanical and electrical properties with extreme flexibility. This has been achieved by welding, with a special heat resisting bonding agent, Tri-acetate or Polyester film to the highest grade of pressboard. The resultant product is a very flexible material combining high electrical and mechanical strength in one material, making it ideally suitable for slot liner insulation. Combined thickness ranges from .005" to .020" and can be supplied in reels cut to any specified width. It is capable of operation at class E Temperatures (120°C.).

DELANCO Tri-acetate combination material, though mainly designed for slot insulation, can also be used for other electro-technical purposes, where a combination of good insulation and only slight layer thickness is demanded. The **DELANCO** technical department has produced a folder giving full technical data, and this with sample, will gladly be sent you on request.

Anglo-American Vulcanized Fibre Co. Ltd

CAYTON WORKS BATH STREET LONDON E.C.1. CLE 3271 Grams: 'PROMPSERV' AVE, LONDON

DELANCO WORKS · LEONARD STREET · LONDON E.C.2

VULCANIZED FIBRE · LAMINATED BAKELITE
PRESSBOARD · PRESSPAHN · CLOTHS, TAPES AND SLEEVINGS

Delanco Electrical Insulation

LEATHEROID · MICA · COMPOSITE INSULATIONS
EBONITE · PRESSED, TURNED AND MACHINED COMPONENTS

WE SPECIALIZE IN UNIT VENTILATION...

LONDON
9, Victoria Street,
London, S.W.1.
Telephone: ABBey 6441

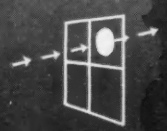
GLASGOW
135, Bath Street,
Glasgow, C.2.
Telephone: CITy 4944

MANCHESTER
58-60, Barton Arcade,
Manchester, 3.
Telephone: Blackfriars 0456

Vent-Axia

BRANCHES IN THE UNITED KINGDOM

AGENCIES THROUGHOUT THE WORLD



BIRMINGHAM
63, Blucher Street, Holloway Head,
Birmingham, 1
Telephone : Midland 4595

NEWCASTLE
42, Jesmond Road,
Newcastle-upon-Tyne, 2.
Telephone: Newcastle 813391

LEEDS
Britannia House, Wellington Street,
Leeds, 1.
Telephone: Leeds 22226

BRISTOL
Brunel House, St. George's Road,
Bristol, 1.
Telephone: Bristol 27567

... and invite you to make use of our free technical service

Field & Grant
LIMITED

ELECTRICAL
AND REMOTE
CONTROL EQUIPMENT

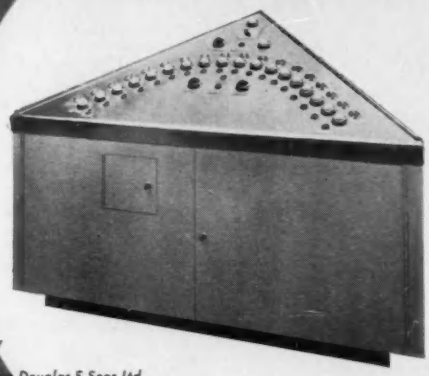


Illustration by courtesy of Messrs. William Douglas & Sons Ltd.

Tailor made to YOUR specification or engineered and designed for YOU

★ LET OUR ENGINEERS HELP TO SOLVE YOUR CONTROL PROBLEMS

Get to know us at—

KENT STREET.
BIRMINGHAM 5.

Telephones: MIDLAND 5675-6
LONDON. HARROW 5578

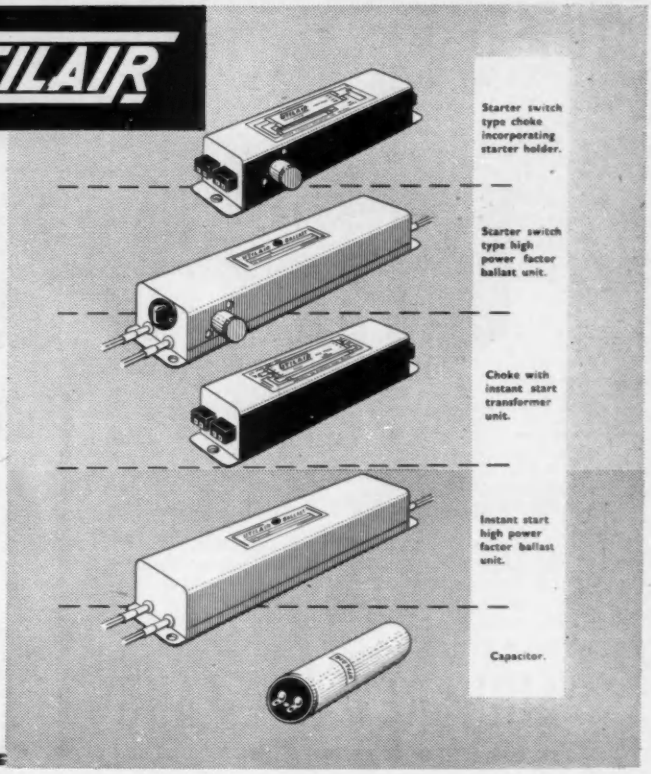
Field & Grant
BIRMINGHAM

The mark of the Specialists

BRITAIN'S BEST
Fluorescent Control Gear
UTILAIR

All types 20/80 watt, single and twin available from stock

Unquestionably the best for
PERFORMANCE
RELIABILITY
VALUE FOR MONEY


Starter switch type choke incorporating starter holder.
Starter switch type high power factor ballast unit.
Choke with instant start transformer unit.
Instant start high power factor ballast unit.
Capacitor.

UTILITIES
(LONDON) LIMITED
Tunstall Road, Brixton, London, S.W.9
Telephone: BRIxton 6811-2-3
Telegrams: "Utilon, London, S.W.9"

We all know this man. He's the chap who has just tried GGL for the first time and can't stop talking about the wonderful quality and service. He's a nice man, really, but he does go on . . . and it isn't as if we old stagers didn't rely on GGL service, too.

CAPSTAN AND AUTOMATIC WORK AND SHEET METAL PRESSINGS IN ANY METAL, ANY FINISH, ANY QUANTITY

G·G·L

FOR QUICK SERVICE AT THE RIGHT PRICE GET IN TOUCH WITH:

GRIFFITHS, GILBART LLOYD & CO. LTD.

Empire Works, Park Road, Birmingham 18. Tel.: Northern 6221.

Simple as

to select the right FAN

The STANDARD AXIALS range from 12" to 27": the STANDARD CENTRIFUGAL range includes forward curve, backward curves and paddle blade.

An Airscrew Specification means what it says

Airscrew can provide the right fan at the right time from their Standard range of Axial Flow and Centrifugal Fans. The Airscrew Technical Service is ready to assist in fan selection from the Standard ranges or by special design when required.
Every Airscrew fan is guaranteed to give its rated duty.

AIRSCREW STANDARD FANS

THE AIRSCREW CO. & JICWOOD LTD., WEYBRIDGE, SURREY Weybridge 2242/7

TESTOSCOPE MAINS TESTER

For high and low voltage testing. Standard Model: range 100/850 volts A.C. or D.C. Dual Model: range 1/30 and 100/850 volts A.C. or D.C. Send for leaflet 259. 16-page booklet "Hints on Electrical Testing" now available—1/- post free.

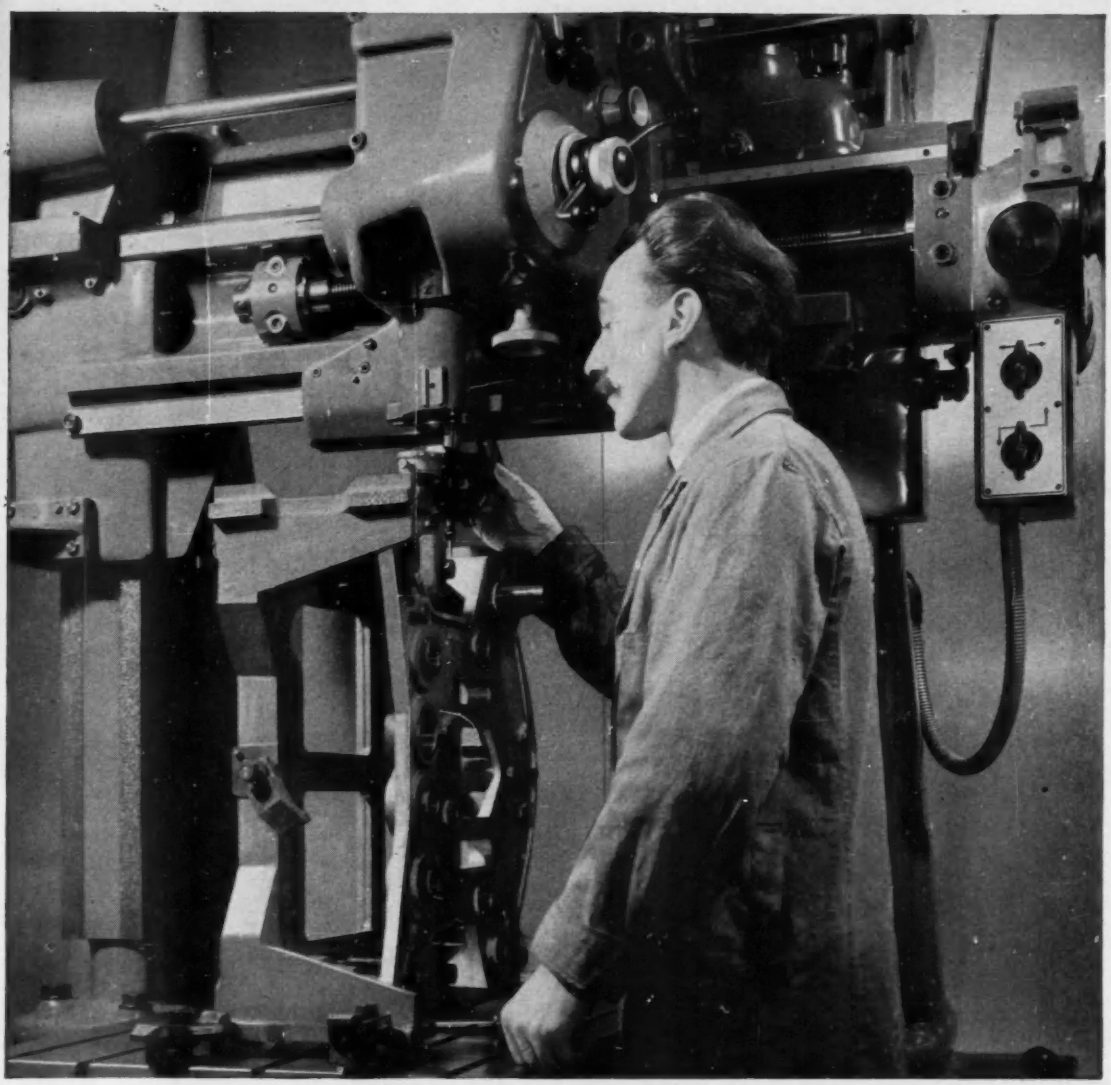
Runbaken MANCHESTER

TRANSFORMERS
CONSTANT VOLTAGE

10 VA – 2,500 VA

Multiple Secondaries all Stabilised.
Any reasonable voltages.
Also fitted with rectifiers for stabilized D.C. supplies.

THE BANNER ELECTRIC CO. LTD.
HODDESDON, HERTS. *Hodd. 2659*
MAKERS OF GOOD TRANSFORMERS



and above all... precision!

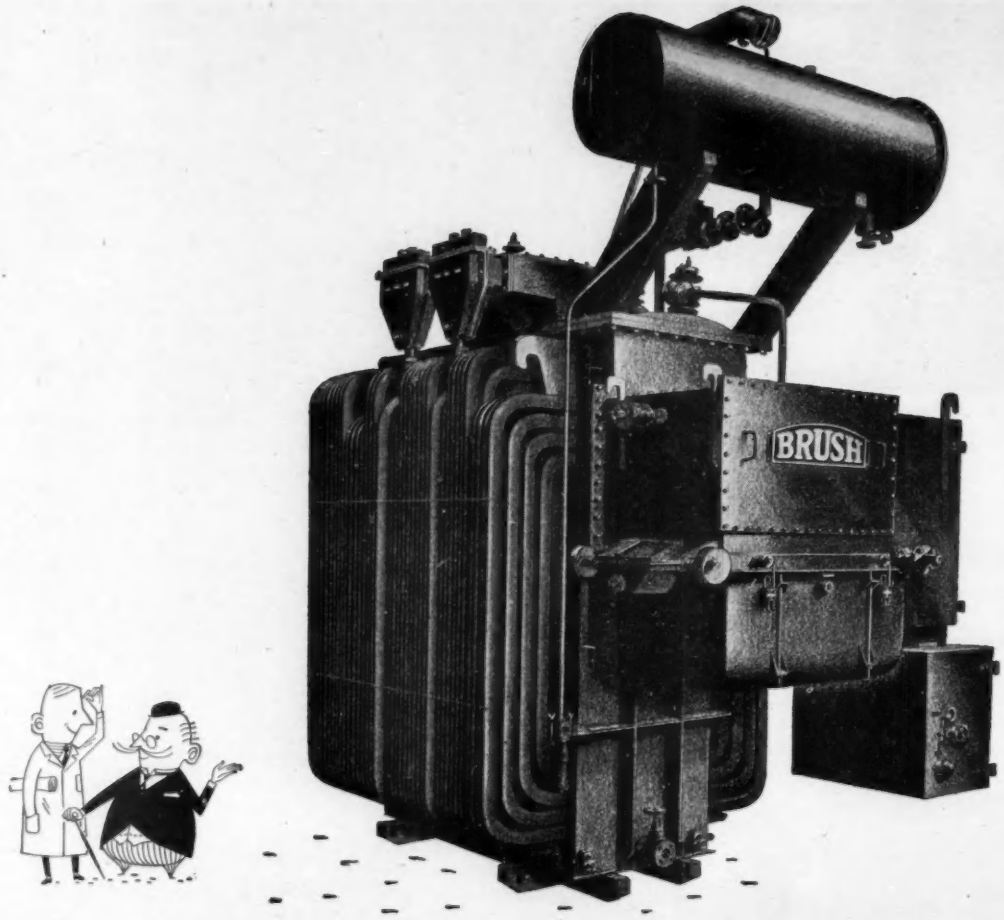
Modern production techniques at George Ellison Limited are based on a traditional belief in *precision*. It is seen in such machines as this modern Jig Borer which operates in its own air-conditioned room, and in the care given by the men on the floor to every stage of machining and finishing. At George Ellison Limited it has become *an attitude of mind* which ensures that you will get many years of unfailing service from your "Ellison" Switchgear.

GEORGE ELLISON LIMITED BIRMINGHAM ENGLAND

Continuing a Tradition

795

C



Why must we have a Brush transformer?

Oh, well Sir, you see ... Well, there's so much one can say ...

All right then, say it man. Why Brush?

Well Sir, first of all I'd like to remind you that Brush built their first transformer as long ago as 1880, and ...

Here! Wait a minute. We're not buying for historical reasons are we?

Of course not Sir, but it's worth remembering that this early transformer was an absolute innovation as far as dependability is concerned, and set a standard for quality that Brush have maintained ever since.

I see. You mean it's Brush experience plus quality that pays in the long run, eh?

I do indeed Sir. After all, it's not by accident that Brush transformers are giving such trouble-free service in every part of the world. And another thing. Think of the meticulous research and thorough tests which must have gone into this high-speed resistor-type tap changing gear we're considering, to say nothing of ...

All right, I see your point.

You mean Sir, that we can get in touch with Brush?

Of course. What are you waiting for?

BRUSH
the power people

For further information on Brush transformers and tap changing gear, write to:
BRUSH ELECTRICAL ENGINEERING CO LTD • LOUGHBOROUGH
A Member of the Hawker Siddeley Group

Z2

FRIDAY
26 DECEMBER
1958

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

In This Issue

Practicable Nuclear Reactors 1167
Of the many possible ways of applying nuclear fission for power production only two promise to compete economically in the near future with conventional methods on a comparable scale. It is shown that the design adopted for Calder Hall has proved a highly satisfactory prototype for the nuclear power stations now being built in this country

Electric Floor Heating Practice—3 1169
This week's article is mainly concerned with temperature control. Reference is made to room and floor thermostats and the principal types of external controller are described

Nuclear Reactor Trends 1174
Further summaries of papers presented at the recent World Power Conference in Canada. The three referred to in this issue deal with operating experience at Calder Hall, the relative importance of short-term improvements in the design of British nuclear power stations, and the economics of nuclear fuels

Industry and the House 1183
In the recent House of Commons debate on the National Coal Board's borrowing powers concern was expressed at the falling demand for coal and the effect of competition from oil

Steel Strip Production 1187
The new Brinsworth mill of Steel, Peech and Tozer, Ltd., is a continuous hot mill for producing high quality steel strip up to 18in wide and down to 0·043in thick. The plant has cost about £4 million, nearly half of this expenditure being on electrical equipment

Merseyside Power Station 1191
This new Unilever power station provides process steam for ten factories and also generates electricity. The plant consists of four 100 klb/hr boilers and four back-pressure turbo-alternators having a total capacity of 14 MW

Vitreous Enamelled Resistors 1193
All types of these resistors made by H. A. Birch & Co., Ltd., at Willenhall, Staffs., are type approved for Services use and this article describes the manufacturing methods employed

✧ ✧ ✧ ✧

Radioisotopes in Industry	1173	**New Electrical Equipment**	1203
Lighthouses and Lightships	1177	**Financial Section**	1204
New Books	1178	**New Patents**	1206
Views on the News	1179	**Forthcoming Events**	1207
Personal and Social	1180	**Contract Information**	1208
Letters to the Editor	1184		
I.E.E. Regulation Amendments	1185	*REGIONAL GUIDE TO ELECTRICAL CONTRACTORS*	59
Industrial News	1198	*CLASSIFIED ADVERTISEMENTS*	63
Generation and Development	1201	*INDEX TO ADVERTISERS*	72

VOLUME 163 NUMBER 26 ✧ *Eighty-Seventh Year of Publication* ✧ FRIDAY PRICE 1s 6d

© Electrical Review Publications Ltd. 1958. Permission in writing from the Editor must first be obtained before letterpress or illustrations are reproduced from this journal. Brief abstracts or comments are allowed provided acknowledgment to the journal is given.

Editorial, Advertising and Publishing Offices: Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: "Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Registered at the General Post Office as a Newspaper. Entered as Second Class Matter at the New York, U.S.A., Post Office. Annual Subscription: Home £4 15s 0d; Overseas £5 15s 0d; U.S.A. and Canada $16.00. Cheques and Postal Orders (on Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD. and crossed "Lloyds Bank."

TEST INSULATION and CONTINUITY with One instrument

the EVERETT EDGCUMBE METROHM

The Metrohm represents a tremendous technical advance in insulation and continuity testers. It combines ease of operation and high technical quality with a sturdy robust design and construction which will ensure very many years of trouble-free service.

Here are some of the METROHM features:

1. 500-volt insulation and continuity tests combined in a single instrument
2. Easy one-hand operation
3. Transistorised for high conversion efficiency
4. Printed circuit for extra reliability
5. Clear-reading protected dial
6. Back cover carried on moulded front panel
7. Practically ripple-free—only 0.1% ripple
8. Long battery-life
9. Good design and quantity production combine to keep the price low

PRICE: *complete with detachable polythene front cover, leather sling strap and 5′ test leads fitted with crocodile prod clips* **£21.12.0d.**

250 and 100 volt models also available. For fuller technical description and applications write for Sheet 242A

EVERETT EDGCUMBE & CO. LTD.

COLINDALE WORKS · LONDON · N.W.9

Telephone: COLINDALE 6045

LONDON OFFICE: COLUMBIA HOUSE · ALDWYCH · W.C.2

Branch Offices: BIRMINGHAM · CARDIFF · GLASGOW · MANCHESTER · SHEFFIELD

DHB/6508

ELECTRICAL REVIEW

26 December 1958 Vol. 163 No. 26 Established 1872

Practicable Nuclear Reactors

FEW major scientific discoveries have been the basis of so many theories concerning the means of their application as has the fission of atomic nuclei. So far only two ways have emerged which offer promise of competing economically in the near future with conventional resources in the production of electrical energy on a comparable scale. One of these is, of course, by means of the gas-cooled graphite-moderated reactor fuelled by natural uranium, as installed at Calder Hall, which for more than two years of uneventful operation has been supplying electricity to the grid. This design has proved to be a highly satisfactory prototype for the reactors with individual ratings up to 250 MW (electrical) now being built for operation within the next two to four years. In an article on another page, which is based on comprehensive papers presented at the recent World Power Conference, we have confined our attention mainly to those aspects which cover practical probabilities relevant to the next decade.

The second type of reactor, which uses pressurised water as coolant and enriched uranium as fuel, is exemplified by the 60 MW reactor at Shippingport (U.S.A.) which started to supply electricity commercially last spring, but particulars of capital cost and operational results over a reasonable period are not yet available. Reports from the United States show that eight other reactors, embodying four different principles, have produced electricity, but their ratings, ranging from 0·2 to 6·0 MW, indicate their embryo status. The United States is not immediately worried by diminishing coal resources because of the plenitude and comparative cheapness of other energy sources there and consequent ability to produce fissile material in quantity, in addition to coping with the normal growth of consumers' demands.

This sense of urgency regarding future supplies of coal has its compensation in that it has resulted here in concentration of scientific and engineering skill on one type of power reactor for industrial uses: a type that makes use of materials and safe techniques which do not entail reaching out further into the unknown than is necessary to meet more immediate needs. The design adopted in this country has manifestly enabled British engineering groups of manufacturing companies to take almost in their stride the construction of the requisite plant. It is also flexible enough to incorporate improvements as they are evolved from experience and to permit adjustment of the balance between capital and fuel costs to meet load factor requirements economically. A further point is that manufacturers here have been able to quote firm prices for nuclear power stations as contrasted with the frequent upward revision of estimates made during construction of other types of reactors elsewhere.

STEELWORKS ELECTRIFICATION

The modern steel industry is very much dependent on the great flexibility and ease of control offered by electric drives. In this issue we describe a very good example of a modern rolling mill drive. This mill is for the continuous production of high quality steel strip, using hot bar as the raw material. It will roll strip up to 18in wide at a rate of up to 8,000 tons per week and to achieve this some 23,000 h.p. of electric drives has been installed.

One of the most interesting features of the mill is that it is rectifier fed, the electrical supply for the main drive d.c. motors being converted from a.c. by a bank of pumpless steel tank grid-controlled mercury-arc rectifiers. When compared with the Ward-Leonard type of drive the number of rotating machines is reduced and the foundations need not be nearly so substantial, thus reducing both initial cost and maintenance. The amount of work which the steel industry provides for the electrical industry may be gauged from the fact that almost half of the £4 million which the mill cost is represented by electrical equipment of one kind or another.

SUPPLY OF TECHNOLOGISTS

When, a few years ago, the Institution of Electrical Engineers, following the warning by the Duke of Edinburgh as President of the British Association, showed its great concern about the low rate at which graduates were entering the Institution, we drew attention to one serious fundamental aspect of the problem. This was the insufficient numbers coming up into the electrical industry from the schools and colleges. In announcing its recent conference on training, which was reported in the *Electrical Review* of 28th November, the I.E.E. stated:—"It has been said that if the technical colleges continue to expand at the present rate they will succeed in providing their share of the extra 10,000 technologists per year which it is estimated will be needed by 1970." This will be a remarkable educational achievement from which the electrical industry will benefit. The industry must continue and extend its interest in technical education to ensure that the pace is maintained.

DUNGENESS INQUIRY

For the third time in two months, at public inquiries held in Kent, the Central Electricity Generating Board has been called upon to defend its plans for meeting the country's future power needs. The latest inquiry, held last week at Lydd, was into the proposed erection of a nuclear power station at Dungeness and of transmission lines from there to Lydd, where a connection would be made with the proposed cross-Channel cable linking England and France. While some fears were expressed on behalf of local inhabitants regarding possible radiation risks, the main objection appears to have been that of the Nature Conservancy, who claimed that the area was a unique one for physiographical research and of special importance to botanists and ornithologists. For the Generating Board it was pointed out that so far as all these interests were concerned it was a question of using only a small part of a considerable area, except in the case of the bird observatory. The whole of the Kent coast line had been considered by the Board in its search for a possible site and at Dungeness there were all the requirements for the erection of a nuclear power station.

BACK-PRESSURE GENERATION

The main differences between the Merseyside power station described in this issue and a conventional power station are the small installed generating capacity (14 MW) relative to the 400 klb/hr boiler capacity, the absence of large quantities of cooling water for the turbines, and the large boiler feed water treatment plant. All these features are characteristic of back-pressure generation, on which principle the new station operates. In the use of steam for process work the most important and useful component is the latent heat in the steam, and the simple objective in a back-pressure plant is to use for this purpose the rejected waste heat from the motive power plant. In this way the rejected heat can be made to replace some or all of the heat which would otherwise have to be provided separately.

To provide separately the motive power and steam now to be supplied, the Merseyside station would have required an annual total of 213,000 tons of coal or its equivalent in oil (which was actually adopted). This is extravagant largely because of the latent heat in the steam for power generation which cannot be converted to mechanical energy and must be dissipated. This loss represents some 60 per cent of the coal supplied for generation. By employing back-pressure generation there is an obvious saving and in the case of the new Unilever plant this is the equivalent of about 55,000 tons of coal per anuum.

LAMP ECONOMICS

Domestic tungsten filament lamps have a rated life of 1,000 hours. Many people still seem to regard this life as a limitation imposed by the lamp manufacturers to ensure continued sales of lamps but it can be quite easily proved that the economic life of a tungsten lamp is about 1,000 hours. To go about it, one needs to know relationships between lamp life, light output and power consumption, the cost of the lamp and the cost of electricity to the consumer. Admittedly there are manufacturing compromises between some of these variables but a minimum standard is set by the relevant B.S. The price per lumen output, taking electricity costs and the price of the lamp into consideration, is a minimum for 1,000 hour rated lamps made to B.S. Specifications. Total cost will increase if non-standard lamps are used, even though the price may be a few pence less.

The next of our monthly surveys of domestic electrical equipment, to be published on 2nd January, will deal with immersion heaters. Although there are only two main types, the removable element and non-withdrawable patterns, these heaters are available in a variety of lengths and loadings. A number of representative designs will be illustrated

Electric Floor Heating Practice

3.—SURFACE TEMPERATURES AND CONTROL METHODS

By R. D. JACKSON*

This is the third in a series of five articles dealing comprehensively with the design of electric floor heating systems. This week the author deals further with floor surface temperatures and also discusses methods of control

IN this country floor surface temperatures are limited by general agreement to 75 deg F. The following figures are the maxima elsewhere:—

Hot water floor panels in U.K.	77 deg F
U.S.A.	80-85 deg F
Germany	77 deg F
France	77-82 deg F

The higher and lower limits in the foregoing temperatures are for room occupants on their feet and sitting down whilst at work, respectively. In the U.S.A. rooms are maintained at higher temperatures.

Some experiments were recently carried out to study the incidence of complaints with different floor surface temperatures, and some of the graphs which were published are reproduced in Figs. 11, 12, 13 and 14 by courtesy of F. A. Chrenko and the Institution of Heating and Ventilating Engineers.

These are sub-divided to show the incidence of complaints from each of the sexes, and it should be borne in mind that men wear shoes having thicker soles than women's, and the tests were carried out with the "guinea pigs" wearing their normal footwear. The incidence of complaint is shown as a percentage. This percentage is derived by counting the number of occasions when discomfort was incurred at a particular temperature, and converting this into the percentage of the total number of experiments made at the same floor temperature. The process was repeated for all the floor temperatures used. The percentage incidence of discomfort is plotted against the temperature of the surface of the floor.

With the women subjects sitting, there were no complaints as long as the surface of the floor did not exceed 77 deg F, but at higher floor surface temperatures dis-

* Technical Director, Tyrad Electric, Ltd.

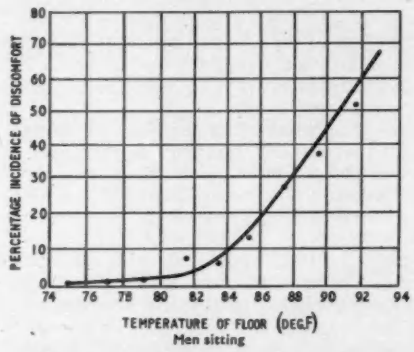


Fig. 11

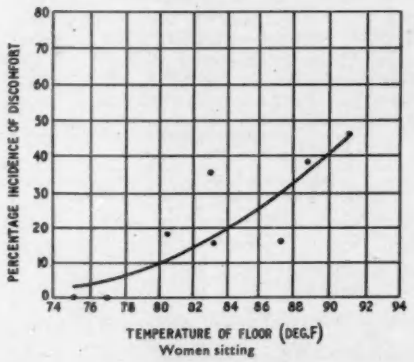


Fig. 12

Fig. 13

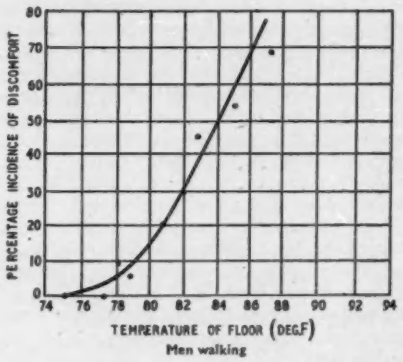
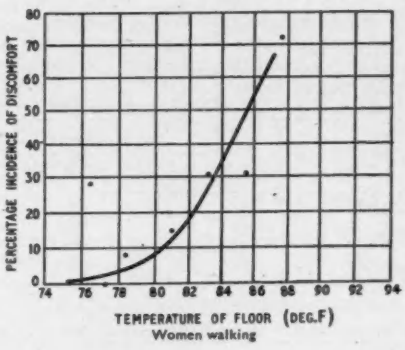


Fig. 14



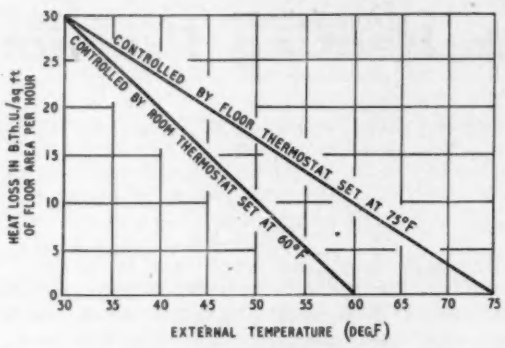

CONTROLLED BY FLOOR THERMOSTAT SET AT 75°F
CONTROLLED BY ROOM THERMOSTAT SET AT 60°F
HEAT LOSS IN B.Th.U./sq ft OF FLOOR AREA PER HOUR
EXTERNAL TEMPERATURE (DEG.F)

Fig. 15.—Heat loss (calculated example)

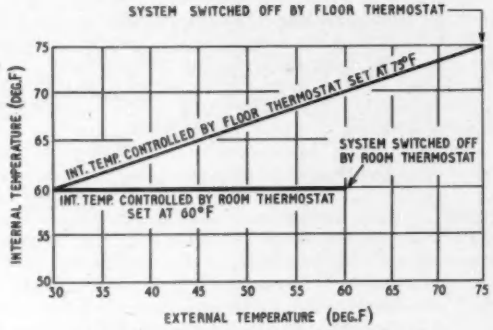

SYSTEM SWITCHED OFF BY FLOOR THERMOSTAT
INT. TEMP. CONTROLLED BY FLOOR THERMOSTAT SET AT 75°F
SYSTEM SWITCHED OFF BY ROOM THERMOSTAT
INT. TEMP. CONTROLLED BY ROOM THERMOSTAT SET AT 60°F
INTERNAL TEMPERATURE (DEG.F)
EXTERNAL TEMPERATURE (DEG.F)

Fig. 16.—Operation of thermostats

comfort was experienced with increasing frequency as the temperature rose. The percentage incidences with floor surface temperatures at 80 deg, 85 deg and 90 deg F were 11 per cent, 34 per cent and 40 per cent respectively.

With women walking, the incidences of discomfort were 8 per cent at 80 deg F and 44 per cent at 85 deg F. With men, the tests showed that no discomfort was experienced up to 79 deg F whilst sitting, or up to 77 deg F when standing and walking about. At 80, 85 and 90 deg F respectively, the percentage incidences of discomfort were 2, 13 and 47 per cent. These compare with 13 per cent and 60 per cent at floor temperatures of 80 and 85 deg F respectively when walking.

At the conclusion of the tests it was suggested that the designer should work on a basis involving up to 10 per cent risk of uncomfortable warming, since such a basis is comparable with other methods. The recommended maxima were:—

1. Subjects sitting—Women ..... 79 deg F
   „ „ Men ..... 84 deg F
2. Subjects walking—Men and women ... 80 deg F

these figures being associated with the 10 per cent incidence of discomfort after one hour's exposure, but the report went on to say that for longer exposures it would be more desirable to limit floor surface temperatures generally to 75-77 deg F.

If the maximum floor surface temperature for electric floor warming was 80 deg F, heat output would be increased by nearly 50 per cent and a great deal of supplementary heating would not be required. Certainly there appears to be a case for a more adjustable outlook on floor surface temperatures, taking into account different types of room and duration of exposure, and the following is a suggested basis for design.

Room occupied for long periods .....75-77 deg F
Room occupied for short periods .....80 deg F
Corridors and other circulating areas 85 deg F

These temperatures are, of course, subject to suitability of floor finish.

Controls

There is a relationship between the floor surface, space and external temperatures in a floor-heated building, in so far as the difference between the first two provides a total transmission rate from the floor equal to the rate of heat loss from the building.

If in a space floor heating operates at 75 deg F surface temperature, to maintain a space temperature of 60 deg F when the outside temperature is 30 deg F, the same space temperature would be maintained with a floor surface temperature of only 67-68 deg F if the outside temperature were 45 deg F, i.e. only half the total transmission rate and only half the heat losses prevail in such a case. Thus floor surface temperatures continually vary to meet the prevailing losses, although this is not easy to record in practice with off-peak operation.

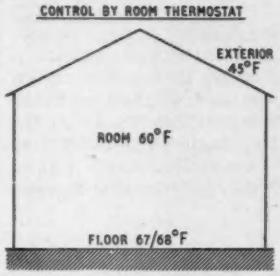
For this reason floor heating installations can be controlled satisfactorily by ordinary room thermostats, and it is the responsibility of the designer to ensure that the maximum floor surface temperature is not exceeded in order to provide for the rate of heat loss prevailing against design outdoor conditions.

If thermostats are embedded in the floor to control the floor surface temperature, there will be fluctuations in space temperature and increased electricity consumption. This is because a thermostat is a device which switches on or off depending solely on the temperature of its environs.

A floor thermostat, if used, would require, as is obvious from the foregoing paragraphs, to be reset from day to day in relation to the prevailing heating requirements, and such a method is impracticable. Thus, floor thermostats, where used inadvisedly, are set permanently to, say, 75 deg F, which temperature may be taken to coincide, for the purpose of an example, with heating requirements against the design outdoor condition of 30 deg F. If the external temperature rises to 45 deg F, thus halving the

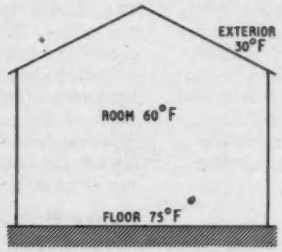
TABLE III.—EFFECT OF VARIATIONS IN EXTERNAL TEMPERATURE (Calculated Example)

External Temp. °F	Control by Room Thermostat			Control by Floor Thermostat		
	Internal Temp. °F	Heat Loss B.Th.U./hr per sq ft Floor Area	Floor Surface Temp. °F	Internal Temp. °F	Heat Loss B.Th.U./hr per sq ft Floor Area	Floor Surface Temp. °F
30	60	30	75	60	30	75
35	60	25	72·5	61·66	26·66	75
40	60	20	70	63·33	23·33	75
45	60	15	67·5	65	20	75
50	60	10	65	66·66	16·66	75
55	60	5	62·5	68·33	13·33	75
60	60	0	60	70	10	75
65				71·66	6·66	75
70				73·33	3·33	75
75				75	0	75



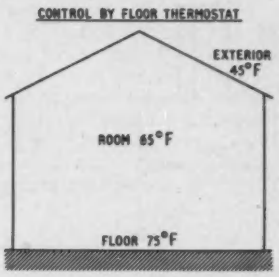
= 15 B.Th.U/hr/sq ft OF FLOOR

Fig. 17



TRANSMISSION RATE FROM FLOOR, HEAT LOSS OF BUILDING
= 30 B.Th.U/hr/sq ft OF FLOOR

Fig. 18



= 20 B.Th.U/hr/sq ft OF FLOOR

Fig. 19

heat losses for a room required to be maintained at 60 deg F, the space temperature would, in fact, rise to a higher level.

Figs. 15 to 19 and Table III show the differences with control by room and floor thermostats, and it is obvious that with a floor thermostat floor heating will remain in operation for longer periods, providing higher temperatures than are actually required and resulting in non-beneficial consumption of electricity. In the extreme, both thermostats will continue in the " off " position until the environs are the same as the thermostat setting. In the example given, the floor thermostat setting is 15 deg F above the room thermostat setting.

Sometimes room and floor thermostats are used in series, under the mistaken impression that a closer degree of control is gained. Since many floor thermostats have a poor differential they might interfere with the close control afforded by the room thermostat, and result in apparently inexplicable variations in internal temperature.

Floor thermostats are useful only as limiting devices where the floor heating system has an appreciable overload. Best results are obtained with ordinary air thermostats installed in boxes in the floor, the boxes being fitted with removable cover plates.

Variations in External Temperatures

Figs. 18 and 19 also serve to show what happens in a floor heated space if there is a 15 deg F variation in an upward direction in external temperature. Individual cases require to be worked out, and a convenient and sufficiently accurate method is to proportion the coefficient of transmission of the floor with the rate of heat loss per square foot of floor area of the heated space per degree Fahrenheit. The simple basis of this calculation is that transmission from the floor is equal to the heat lost from the space.

If the floor surface temperature already established is 75 deg F, the coefficient of transmission is 2 B.Th.U. per hour per square foot per degree Fahrenheit, the rate of heat loss is 1 B.Th.U. per hour per square foot per degree Fahrenheit, and the external temperature rises, after this situation has been established, from 30 deg F to 45 deg F, the difference between floor surface and space will be:—

$$\tfrac{1}{3}(75 \text{ deg F} - 45 \text{ deg F})$$

and the difference between the space temperature and the external temperature will be:—

$$\tfrac{1}{3}(75 \text{ deg F} - 45 \text{ deg F}) = 10 \text{ deg F and } 20 \text{ deg F}$$

respectively.

The space temperature would therefore be 65 deg F.

The same variations occur when the outside temperature falls after a given floor surface temperature has been established, but this is theoretical and, in practice, the variations in internal temperatures are found to be somewhat less. At the same time, variations downwards of 15 deg F over a short period are infrequent in this country, and in any case there is always a time lag between variation in external temperature and its effect on internal temperature. Generally speaking, the next period of intake will occur in time to reinstate the internal temperature.

It might be said in respect of increases in external temperature with the consequential increase in internal temperature above the specified level, that electricity and, therefore, money, is wasted, and such waste does not occur with other more direct forms of heating, which are therefore to be preferred.

If an electric floor heating system is installed it is because the running cost is lower than that of the alternatives for the duration of a full heating season. The floor heating system is still cheaper to run than the alternatives, notwithstanding the fact that some waste of heat may occur on mild days, the excessive consumption being part of the annual consumption on which estimates of running costs are originally based.

The self-regulating quality of floor warming will be noted. Heat transmission is reduced with considerable effect if the room temperature increases, and electricity consumption is lighter during the subsequent intake period.

External Controllers

With off-peak operation the heating system has to consume sufficient electricity to provide for the heat dissipated during intake and the reinstatement of storage capacity, and it is obviously preferable to meet these two conditions as near as possible to the commencement of the next occupancy period.

If a building stands at full comfort level, the rate of heat loss is at the maximum in relation to the prevailing external temperatures, and this maximum heat loss should be confined to the shortest possible period when the building is unoccupied. A fall in comfort level between occupancy periods must result in a saving in electricity consumption, but the fall must be controlled to a point from which it is possible to recover with the available installed loading and the remaining hours of intake.

External controllers of various types are available and the main ones are:—

1. Two ordinary room thermostats, one fixed internally and one fixed externally in a suitable case, with the internal thermostat wired to switch an " accelerator "

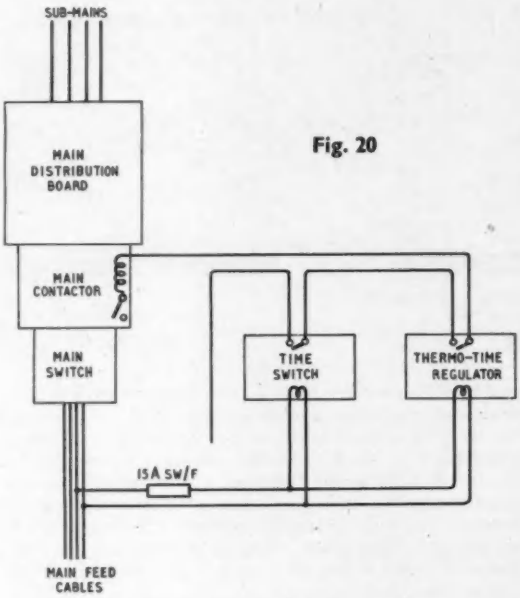


Fig. 20

in the external thermostat, the contacts of which are in series with a time switch.

2. The thermo-time regulator, which may or may not be used in conjunction with a time switch.

With external controller type No. 1, the thermostat fixed inside the building controls electricity supply to an accelerator (heater) fitted inside the thermostat fixed externally.

The inside thermostat has contacts which make on temperature rise, and those in the outside thermostat make on temperature drop. The inside thermostat is normally set at the temperature to be maintained internally, and as long as this thermostat makes contact the heater is in operation in the outside thermostat and will cause it to break circuit earlier. The outside thermostat is set at, say, 50 deg F.

This method of operation is not really relating prevailing weather conditions with available heating load and remaining hours of intake, and since there is an appreciable time lag in the variations in external temperature affecting internal temperatures, it would appear that unsatisfactory internal temperatures are likely to result on several occasions in the course of a heating season.

However, this form of external control is comparatively cheap, and practical experience might show that few inaccuracies occur in practice or that such inaccuracies as do occur are a reasonable risk from the point of view of the consumer.

The thermo-time regulator is an instrument having a time base and temperature base, and whilst there are three or four models available to suit the varying requirements of different buildings, they all provide the same method and degree of control.

The instrument embodies a synchronous motor driving a cam, and this cam is shaped to suit the particular installation. A thermostat in the instrument effects the position of switching contacts in relation to the cam, so that if external temperatures and duration of intake are related at their upper and lower limits there is automatically relationship for all temperatures and intake hours between these limits. The cam shows both time and temperature bases, the former being marked off on the circumference and the latter radially.

These instruments can be supplied with an electrically-wound spring reserve, and in all models the cam is normally shaped to perform the main off-peak switching, i.e. at the prescribed off-peak hours, thus duplicating the work of the time switch, which might be considered an advantage in the event of a fault in the latter. Fig. 20 shows the general arrangement where a thermo-time regulator is incorporated.

Intake Hours

There is no such thing as "designing a floor heating system for off-peak operation," in the sense that the designer takes steps of an especial nature upon some theoretical basis. In the absence of a method of calculation the practice is to compare the floor construction with others which have proved satisfactory, and nearly all of these have twelve hours' overnight intake, with a mid-day boost. There are odd freaks where, for no apparent reason, the mid-day boost, although allowed, is never used, and the overnight consumption never commences until nearly midnight, but there are no apparent reasons why these installations perform so much better than others where building construction and general details are comparable.

There are comparatively few cases where only an overnight intake has been proved to be sufficient, and there is not in existence any reasonably accurate formula for calculating the utilisation of the thermal storage capacity of floors and the duration of intake required. Formulæ have been advanced for this purpose, but without exception they only prove that electric floor heating does not work at all, and this we know to be untrue.

Sometimes, when inquiries for electric floor heating are received, the letter accompanying the drawings concludes by stating "the system should be designed to operate with intake restricted to 7 p.m. to 7 a.m.; no mid-day boost is permissible." In some cases, alternative proposals are requested to show the difference in loading, cost and consumption, if intake is 9 p.m. to 7 a.m. These inquiries, which are quite common in occurrence, presuppose that the building in question is suitable, and that the designer can deal with the natural properties of the building structure as though it were a water storage cylinder of determinable and governable content.

A variation in heating load could be arrived at for various hours of intake since only arithmetic is involved, but what is not known is whether given floor constructions will enable enough heat to be stored for dissipation at the required rate for the whole of the working day. If an existing installation operated satisfactorily with only an overnight intake, it would be possible to further reduce the intake period by increasing the heating load, i.e. by providing the same heat input over a shorter period, but this would be because it had been proved that sufficient heat could be stored to last until the end of the working day. With many installations the mid-day boost is hardly used during October, November, March and April and sometimes December, but invariably January and February see the boost almost fully absorbed.

A sizeable building has to be treated on the basis of the intake requirements of the rooms having the worst conditions to meet. Rooms on the top floor or at the ends where exposures are increased, dictate intake hours for the whole building. Also, it will be remembered, top-floor rooms are losing heat downwards as well as upwards, which means that the natural storage is exhausted at a greater rate.

Thermal storage is exhausted in proportion to the

difference in temperature between the floor and the space. Where floor temperatures are well up towards the limit in buildings used as stores and maintained at comparatively low internal temperatures, the stored heat might be dissipated twice as quickly as in buildings of good thermal construction maintained at a full comfort level.

No mention has been made of the heat stored elsewhere than in the floor. This is because such other storage can only be in internal partition walls, and perhaps furniture and fittings, and some degree of storage in this way is achieved in all heating systems. As floor heating results in higher fabric temperatures, some advantage in this respect might be claimed, but the difference is probably very small as compared with the main bulk stored in the floors. For this reason, floor warming will perform as well in lightly constructed buildings as in buildings of traditional construction, provided the light construction is of comparable thermal value.

Radioisotopes in Industry

Author's summary of a paper on the uses of radioisotopes read before the Incorporated Plant Engineers, Manchester

By W. G. BUSBRIDGE*

IN the post-war development of atomic energy, Britain has played a leading part in two main conceptions. One of these is the development of electricity generation from nuclear power, and the other is the production on a commercial scale of radioactive isotopes, made by placing the common stable isotopes of chemical elements in the neutron flux of an atomic reactor. Inasmuch as the fission of uranium in an atomic power station gives rise to about 200 radioactive isotopes of about 40 different elements, these two conceptions are closely allied to one another.

Today the value of the British trade in radioisotopes is about £600,000 per annum. More than half of these are exported and their value is greater than that of the isotope exports of all the other countries in the world combined. Their true value is measured by the savings which they can achieve in industry, which is many times the value of the isotopes themselves.

Tracer Techniques

When a disproportion exists in a nucleus between the numbers of neutrons and protons, the nucleus is unstable or radioactive, and emits a high-speed nuclear particle in an effort to stabilise itself. One gram of a typical radioisotope, sodium 24, emits approximately three hundred and fifty thousand billion beta particles a second. These beta particles are capable of being detected individually by instruments such as the Geiger counter. If we can detect one per second (which is not difficult to do) we can obviously detect or measure one three-hundred-and-fifty-thousand-billionth of a gram of sodium 24. Thus, materials like this lend themselves readily to the tracing and measurement of flow and leakage in any kind of fluid system, from the flow of blood in the human body to the movement of silt on the ocean bed. Their application to every kind of industrial problem of flow or wear is apparent.

Attenuation and Scatter

Radiation, like light, obeys the inverse square law, and is also attenuated and scattered in its passage through matter. Radioisotopes, therefore, lend themselves to the measurement of thickness by the change in the amount of radiation transmitted. This permits of accurate production control of any type of continuous sheet material without contact with the surface. Thus, the material can be measured while wet or white-hot and while in motion and, in fact, in many conditions where normal micrometry and gauging are inapplicable.

Measurement of "back-scattered" radiation enables thickness to be measured from one side of the material only, and can be applied to instruments for measuring corrosion in pipes or boiler shells, or to gauges for plating or coating thickness. The measurement of liquid levels in the cases of liquids which are hot (e.g. molten metal) or highly corrosive or volatile (e.g. liquefied gases) is not easily achieved by conventional methods, but can be done by the use of radioisotope gauges.

Photographic Applications

The fact that radiation renders a photographic emulsion developable leads to the use of sources of gamma radiation as an inexpensive and trouble-free substitute for an X-ray set and one which, owing to independence of electrical power, may be used in remote places or even under water.

Conclusion

The use of isotopes in industry can lead to many economies through increase of speed of production, saving in manpower in gauging and checking, reduction in number of faulty or incorrectly gauged components and extension of the scope of industrial research. Their availability in ever-increasing quantities will be of significant value to industry of every kind.

* Atomic Energy Research Establishment, Harwell.

Medical Electronics Group

THE British Institution of Radio Engineers announces the formation of a Medical Electronics Group. This is in accordance with the policy of the Council to establish specialist groups to foster the holding of meetings, the presentation of papers and the general dissemination of information in the specialised fields of radio and electronic engineering. The chairman of the Group Committee, Mr. W. J. Perkins, was the Institution's representative at the International Medical Electronics Conference held in Paris last May.

There will be five meetings of the Brit.I.R.E. Medical Electronics Group during the current session. The inaugural meeting will be held on Friday, 23rd January, when Professor A. V. Hill, C.H., Emeritus Professor of Physiology at University College, London, will give an address.

NUCLEAR REACTOR TRENDS

DESIGN, OPERATION AND ECONOMICS

OPERATING experience at Calder Hall power station since it started to supply electricity to the grid in October, 1956, provided the background for an assessment of the future of nuclear power systems which Sir Christopher Hinton and Mr. L. Rotherham (Central Electricity Generating Board) presented at the World Power Conference (Canadian sectional meeting). The considerable advances made since 1956 in the growth of output per reactor while using the present thermodynamic cycle are shown in the four stations now being built specifically for public electricity supply (see Table I). These improvements, while mainly due to straightforward engineering, indicate the adaptability of gas-cooled graphite-moderated reactors in regard to the next major step forward. That will call for technological studies with the aim of raising the top temperature in the heat cycle, as in conventional power stations, which the authors regard as more important than increasing fuel-element rating as a means of reducing both capital and running costs.

The only other developed reactor that would be seriously considered today for large land-based power stations is held to be the pressurised-water design, as first put on load this year at Shippingport (U.S.A.), in regard to which insufficient operating information is as yet available. In this type a slightly lower capital cost per kW installed is offset by the need to provide against the corrosive action of water at high pressures and temperatures. This has entailed the use of zirconium fuel cans, the expense of which has necessitated the adoption of relatively closely spaced ceramic-alloy fuel elements and fuel ratings and burn-ups that go considerably beyond those in Britain. Enriched uranium is required on that account and because light water as a moderator is wasteful of neutrons. Enrichment costs less in the U.S.A. than here, largely owing to the lower costs of the large amounts of electricity taken by diffusion plants. These high ratings make it doubtful whether further material increases can be achieved, whereas the gas-cooled type leaves a considerable margin for future developments.

Sir Christopher Hinton

Mr. L. Rotherham

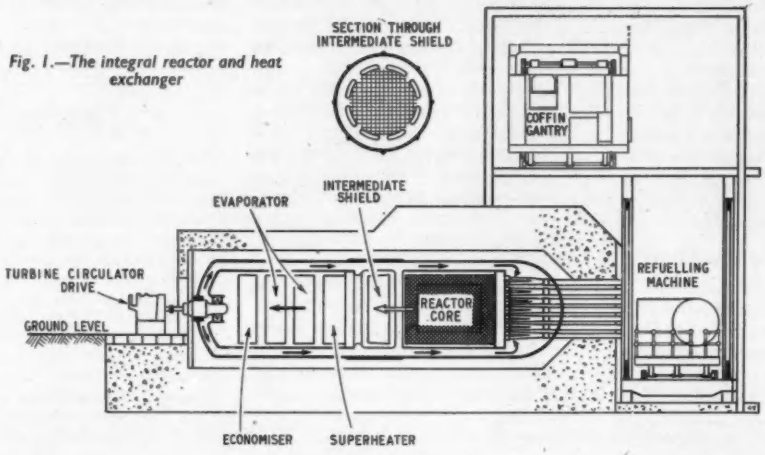
Of the many other reactor systems theoretically possible, only the graphite-moderated sodium-cooled principle seems to offer prospects of competing with pressurised water. Although liquids provide better cooling media than gases, the latter are much less chemically reactive at high temperatures. A design study by the U.K. Atomic Energy Authority showed that British resources would be more fruitfully employed in securing the maximum development of gas cooling. The higher gas outlet temperatures envisaged (550 to 600 deg C) would necessitate the use of more expensive canning material, such as beryllium, having a much higher melting point than magnox. Its cost could be justified only by increasing fuel-element ratings from about 2 MW to nearly 10 MW per tonne and burn up from 3,000 to nearly 10,000 MW days. In future gas-cooled reactors alloy steels might be employed in the construction of the pressure vessel for gas circulating ducting, but a more promising alternative would be the integral type of reactor and heat exchanger the layout of which is illustrated in Fig. 1. This would obviate problems of duct design and ensure that the pressure shell would be subjected only to the lower temperature of the gas re-entering the reactor core. The long-term future of nuclear power, however, depends essentially on improvement of load factor.

The relative economic importance of short-term improvements in the design of British nuclear power stations was discussed by Messrs. H. West and A. L. Shaw (A.E.I.-John Thompson Nuclear Energy Co.), who referred to the Berkeley, Bradwell and Hunterston stations

TABLE I.—*Main parameters of British nuclear power stations in operation or under construction*

Characteristics	Calder	Bradwell	Berkeley	Hunterston	Hinkley Point
Net electrical output (MW/reactor)	34	150	138	150	250
Heat output (MW/reactor)	182	530	554	530	960
Overall efficiency (per cent)	19	28	25	28	26
Uranium charge (tonnes)	130	240	252	251	370
Average fuel rating (MW/tonne)	1·4	2·1	2·1	2·1	2·6
Gas inlet temperature (deg C)	140	180	160	204	180
Gas pressure (lb/sq in)	100	133	125	150	185
Pressure vessel Dimensions	Cylinder 37ft dia., 70ft high	Sphere 67ft dia.	Cylinder 50ft dia., 80ft high	Sphere 70ft dia.	Sphere 67ft dia.

Fig. 1.—The integral reactor and heat exchanger



as truly "Mark 1" of the Government programme. Hinkley Point was regarded as coming between these and the later "Mark 2" stations. To the estimated capital costs must be added £10/kW at least to cover land purchase, high-voltage substation, access roads and other items varying with load and site conditions. Attainment of higher thermo-dynamic efficiency, as aimed at in coal-fired plants, is secondary to reduction of capital cost in the design of nuclear stations. Until a basically different canning material, such as beryllium, is available reactor gas-outlet temperatures are unlikely to rise above 400 deg C. Nevertheless experience has shown that plenty of scope exists for reduction in overall cost through refinement of design details and through increasing output without exceeding the metallurgical limits imposed by magnox cans. Spectacular results can be gained by increasing core diameter by 10 per cent, reducing the lattice pitch of the fuel elements (thus increasing the number of channels), raising coolant pressure by 40 per cent and blower pressure slightly, all without materially affecting fuel-element design and performance, though somewhat increasing the fuel charge. By such means the net electrical output of Hinkley was two-thirds more than the earlier Bradwell, but at a lower thermal efficiency. In the true Mark 1 stations roughly 25 per cent of the capital expenditure in each case is incurred on account of the reactor units, gas circuits (including boilers and blowers), generating plant at £30/kW and civil engineering (including biological shields). For the intermediate type the corresponding percentages appear to be 24, 38, 32 and 24 and Mark 2 stations are unlikely to show more than marginal improvements over Hinkley. It may well pay to hold back a rise in gas-outlet temperature to save capital cost until a new canning material permits a significant advance.

Mr. H. West

Mr. A. L. Shaw

Construction of gas-cooled graphite-moderated reactors overseas is regarded as offering no great problems, even in countries subject to seismic disturbances. Their economy will depend largely upon rates of interest and amortisation periods as well as on cost comparison with other forms of generation. Specific capital cost rises rapidly for reactors of less than 100 MW (electrical), but can be lessened if necessary by using slightly enriched fuel and thereby incurring a higher running cost.

TABLE 2.—*Salient differences between Mark I nuclear stations*

	Berkeley	Bradwell	Hunterston	Hinkley Point
Pressure vessel shape	Cylinder	Sphere	Sphere	Sphere
Core dia/height ratio ...	1·75	1·56	1·93	1·76
Uranium per reactor, tonnes	252	240	251	370
No. of gas circuits ...	8	6	8	6
Type of blower ...	Axial	Axial	Centrifugal	Axial
Blower motors ...	Induction	Induction	D.C.	Induction
Blower motor speed control	Hydraulic couplings	Variable frequency supply	Mercury arc rectifiers with phase shifters	Variable frequency supply
Source of blower supply	Main set and unit transformers	Aux. turbo-alternators	Main sets	Aux. turbo-alternators
No. of main turbo-alternators	4	6	6	6
Turbo-alternator units	85 MW	55 MW	60 MW	93·5 MW
Site erection crane ...	Monotower	Goliath	Goliath	Goliath

Discussing the economics of nuclear fuels Messrs. J. A. Jukes and J. K. Wright (U.K. Atomic Energy Authority) showed that experience gained at Calder Hall with natural uranium magnox-canned fuel elements made it possible now to assess the cost and performance of fuels for the first civil nuclear power stations.

Mr. J. A. Jukes

Mr. J. K. Wright

After describing the characteristics of those likely to be employed within the next ten years, namely natural uranium, slightly enriched uranium or a mixture of uranium and plutonium, the authors considered the prospects for thorium, from which the fissile isotope U233

TABLE 3.—*Probable cost per kWh sent out from nuclear stations having two reactors each at 80 per cent load factor and contemporary coal-fired stations. Rate of interest 6 per cent; amortisation period 20 years; rate of capitalisation 8·75 per cent*

Assumptions	Typical Mark I Nuclear Station (300 MW net)			Equivalent Coal-fired Station (280 MW turbo-alternators)			Intermediate Nuclear Station (500 MW net)			Typical Mark II Nuclear Station (500 MW)			"Mark II Contemporary" Coal-fired Station (550 MW turbo-alternators)		
Commissioning date ...	1961–62			1961–62			1962–63			1963–64			1963–64		
Specific capital cost ...	£145/kW			£55/kW			£125/kW			£125/kW			£50/kW		
Fuel cost delivered ...	£17,500/tonne			£4·8/ton*			£17,500/tonne			£17,500/tonne			£5·25/ton*		
Overall thermal efficiency	27·5 per cent			36 per cent			25·5 per cent			28·5 per cent			37 per cent		
Fuel consumption ...	106 tonnes/ann.			0·95 lb/kWh			191 tonnes/ann.			171 tonnes/ann.			0·92 lb/kWh		
Fuel investment ...	500 tonnes						740 tonnes			600 tonnes					
Irradiation	3,000 MWd/tonne						3,000 MWd/tonne			3,000 MWd/tonne					
Cost Component	**Annual Cost £ million**	**Pence per kWh**	**Per cent of total**	**Annual Cost £ million**	**Pence per kWh**	**Per cent of total**	**Annual Cost £ million**	**Pence per kWh**	**Per cent of total**	**Annual Cost £ million**	**Pence per kWh**	**Per cent of total**	**Annual Cost £ million**	**Pence per kWh**	**Per cent of total**
Capital charges	3·81	0·435	56·5	1·44	0·165	23·5	5·47	0·375	52	5·47	0·375	55	2·19	0·150	21
Interest on fuel charge...	0·53	0·060	8	—	—	—	0·77	0·053	7·5	0·63	0·043	6	—	—	—
Fuel cost	1·86	0·212	27·5	4·27	0·488	69·5	3·34	0·229	32	2·99	0·205	30	7·57	0·519	72
Operation and maintenance	0·53	0·060	8	0·44	0·050	7	0·88	0·060	8·5	0·88	0·060	9	0·73	0·050	7
	—	0·767	100	—	0·703	100	—	0·717	100	—	0·683	100	—	0·719	100
Less Plutonium credit at £5,000/tonne	0·53	0·061	8	—	—	—	0·95	0·065	9	0·85	0·058	8·5	—	—	—
	—	0·706	92	—	—	—	—	0·652	91	—	0·625	91·5	—	—	—

* Calorific value 10,000 B.Th.U./lb.

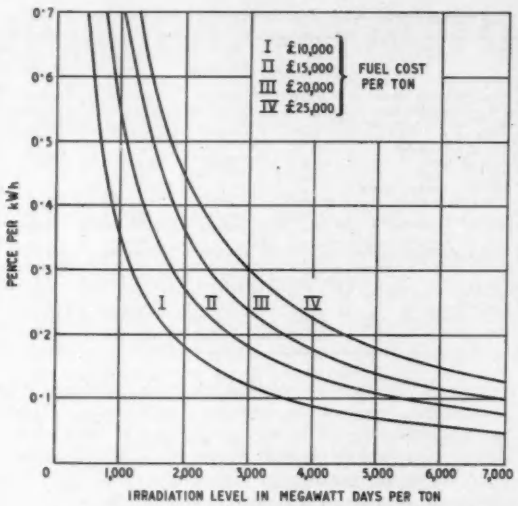


Fig. 2.—Effect of changes in irradiation level at different nuclear fuel prices in cost per kWh generated

could be produced when irradiated by neutrons. A reactor programme operating on the U233 thorium cycle would require for starting some tons of costly fissile material, derived either from a large processing plant or from reactors producing plutonium. Thorium had other disadvantages chemically and was unlikely to be used in quantity for many years.

In regard to the outstanding influence of irradiation level on economy, the view was expressed that fuel used in commercial reactors during the next decade will probably give an average irradiation of between 3,000 and 10,000 megawatt-days per tonne, corresponding to an overall burn-up of fissile and fertile material of between 0·3 and 1·0 per cent plus what may be recovered from irradiated fuel. Fig. 2 shows the effect of changes in irradiation level on the net cost of fuel (per kWh generated) after allowing for the value of irradiated fuel.

Below 3,000 MW-days/tonne the cost would rapidly rise to points at which it would exceed that of conventional fuels in many countries. At more than 6,000 MWd expensive fuel elements could be tolerated if they gave high irradiations, but an increase from, say, 6,000 to 7,000 MWd would not be worth having unless the net fuel costs were less than about £2,000 a tonne. Increases in cost of fuel have to be paid for on purchase, whereas the benefit of higher irradiation levels may not be obtained for several years. Limits to the irradiation level are set by metallurgical or other physical factors or by loss of reactivity. The second effect may be postponed by removing fuel elements periodically from areas in the reactor of high neutron flux density to those of lower value and vice versa.

RECORDING SWITCHGEAR BEHAVIOUR

Uniform Classification Needed

FOLLOWING a visit of the Manchester Technical Group of the Electrical Power Engineers' Association recently to the works of Ferguson Pailin, Ltd., where switchgear up to 275 kV rating and current transformers were seen in course of manufacture, a paper was presented by Messrs. L. J. Bamber and W. Weston on a statistical approach to switchgear behaviour. Pointing out that features providing for selective automatic disconnection accounted for a high proportion of the costs of a switchgear installation, the authors submitted that realistic appraisal of the risks and consequences of faults was analogous to insurance and should be based on statistics derived from national experience, a suggested data form for which was shown in the paper.

Such a widespread system might show the acceptance of remote risks to be justifiable, whereas local experience only might result in safeguards that were too expensive. Many supply authorities already recorded the needed information, but lack of uniformity in classification prevented integration, for which the records of manufacturers regarding their own products would be inadequate. The help of specialists in manufacture would nevertheless be of mutual benefit in less simple cases and in ensuring correct diagnosis.

Available statistics revealed a low fault incidence for switchgear. In one distribution area with 16,500 circuit-breakers, out of 8,800 fault reports in five years only 105 were associated with switchgear. A switchgear manufacturer had only 129 incidents reported in four years with 45,000 circuit-breakers in service at home and overseas. The task of recording faults in the manner proposed should, therefore, not be onerous.

The requisite information could be covered by a standard punched-card tabulating equipment as used for general accounting purposes. Particulars were given of five types of breakdown to indicate the approach to diagnosis. The economic and safety aspects of system faults were dealt with in relation to the function of switchgear, including protective apparatus. Collective experience could also contribute to answering questions in connection with standard specifications and installation practice such as the necessity or desirability of voltage transformer fuses, the necessity of isolating voltage transformers, the effects of atmospheric pollution on switchgear and the effect of cyclic loading on switchgear and on filling media.

Semi-Enclosed Fuses

POWER fuses of the type in which the element—usually a wire—is replaceable by the user have until now been dealt with in B.S. 88, which also covers cartridge-type fuse links. A new publication, B.S. 3036 : 1958, "Semi-enclosed Electric Fuses, Ratings up to 200 A and 250 V to Earth," deals only with the rewirable type of fuse and specifies a range of sizes of fuse carriers and bases suitable for use in either a.c. or d.c. circuits. Each size is assigned to one of six categories of duty according to the prospective current and time constant of the circuit in which they have been tested.

The symbols used in this publication indicating the duty categories are directly related to the breaking-capacity rating of the fuse, and the range of ambient temperatures for which the fuses are suitable is now aligned with that associated with other specifications for switchgear, namely 35 deg C average and 40 deg C peak. Copies of B.S. 3036: 1958 may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 8s 6d.

LIGHTHOUSES AND LIGHTSHIPS

Improvements in Electrical Equipment

The South Goodwin lightship ready to be towed into position

IN an article entitled " An Electrical Centenary " in the *Electrical Review* of 5th December, reference was made to the fact that, in December, 1858, an electrical generator was connected to the South Foreland Lighthouse. Many of the electrical engineering industry's pioneers, including Floris Nollet, Sir John Douglass and Michael Faraday, used lighthouses as a proving ground for early machines. Indeed, there are still in existence, and in working order, several lighthouse machines over 60 years old.

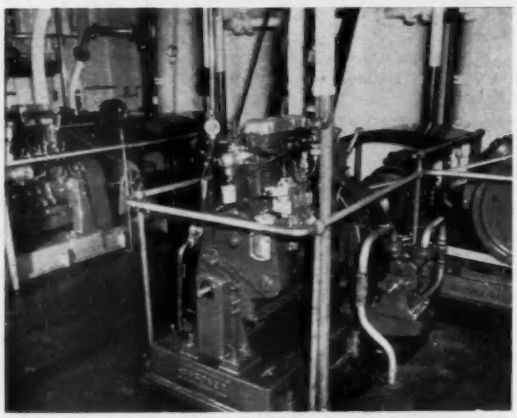
The success of the South Foreland installation was not considered sufficiently conclusive to signal the start of an immediate change-over from oil and petroleum-vapour lighting elements to electric lamps. It was not until about 1928 that the unstable character of the arc lamp caused it to be finally abandoned in favour of filament lamps supplied from an 80 V d.c. source.

Today, 33 of the 34 manned lightships stationed around the British coast, and most lighthouses, are fully electrified and during the next five years the Corporation of Trinity House—the lighthouse authority for England, Wales and the Channel Isles—hope to have completely re-equipped the remaining stations with modern rotating plant and up-to-date aids to navigation.

The average cost of fitting out a lighthouse with modern equipment is between £10,000 and £15,000, but it can be considerably more where site conditions are exceptionally difficult.

Until about 1936 the generating plant in lighthouses and lightships consisted mainly of low-speed semi-diesel engines driving 80 V d.c. machines to supply the 3 to 4½ kW filament lamps. Today most lamps operate at 100 V and range from 375 W in a lightship multi-mirror projection apparatus to 1½ kW in a lighthouse rotating lens, although many larger lamps are still in operation.

Two four-cylinder Gardner diesel engines and Crompton Parkinson 5½ kW generators in the No. 11 lightship. The Reavell compressor is belt driven from the main shaft



Since 1936 Trinity House have used Gardner L.L.2 9½ h.p. fuel-injection diesel engines and Crompton Parkinson 5½ kW, 100 V, 1,000 r.p.m. compound-wound drip-proof enclosure generators. Both machines are mounted on the same bedplate and have a combined weight of 17 cwt. A 75 A circuit-breaker is provided for each generator set. For the powerful diaphone fog signals, most installations have a Gardner 4 L.W. 38 h.p. diesel engine driving a 5½ kW generator and a Reavell Q.R. compressor mounted on a separate bedplate. Although the output of two 5½ kW generators is invariably adequate, four generators are installed in order to give 100 per cent standby capacity in the event of a breakdown.

Current Trends

Two new vessels have recently been added to the lightship fleet and these incorporate many improvements. Electric kettles, cabin heaters and even television sets are now becoming accepted features of a lightship. Many marine appliances, such as electric boat hoists and bilge pumps, are also to be found in the new ships.

To cope with the increased electrical load, the new lightships are equipped with two 10 kW and two 5½ kW generators. The larger machines are used at night when the load is greatest and the 5½ kW machine takes over during the hours of daylight when the lighting apparatus is not in use.

The latest electrical feature to be added to lighthouse installations using public mains supply is the automatic mains failure set. Essentially, these sets consist of a diesel engine driving a Crompton Parkinson " Magnicon," or McFarlane alternator. The alternator may be single- or three-phase and between 6 and 12 kVA depending upon the particular requirements of the lighthouse. Control equipment for the set is contained in a separate cubicle and enables a set to start automatically, taking over the load when the mains fail or vary by more than ±10 per cent for more than 5 seconds; the set responds in 15 seconds. In addition, automatic shut-down and lock-out of the set takes place in the event of the engine's lubricating oil pressure dropping or the engine cooling water temperature exceeding a certain value. Such automatic sets are already working at North Stack Fog Signal Station, at Cromer Lighthouse and at St. Anns Lighthouse. Further sets are on order for Anvil Point, Bull Point and Dungeness Lighthouses.

NEW BOOKS

Reflex Klystrons. By J. J. Hamilton. Pp. 260; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 45s.

Reflex klystrons are the simplest embodiment of the velocity modulation principle, which is now almost universally used in modern microwave valves. They consist of an electron gun, which forms an intense beam of electrons focused through a pair of apertures in a single-cavity resonator. The electrons pass through the cavity in the forward direction and are then reflected by a negative electrode, the reflector or repeller, and return through the same aperture. The velocity modulation imposed on the beam in the first passage through the cavity is converted to current modulation-bunching during the transit to the reflecting surface and back, and the current "bunches" excite oscillations in the cavity. The main advantages of the reflex klystron are the single cavity only requiring tuning and the frequency adjustment obtainable by altering the d.c. reflector voltage. Reflex klystrons are universally used as local oscillators in microwave superheterodynes and as low power f.m. transmitters.

The theory and operation of reflex klystrons has been well understood for many years and several books and major articles published at the end of the war gave detailed accounts of this work. One would expect, therefore, that a new book on the subject would attempt to go well beyond the ground covered in earlier publications both on the theoretical side and in the description, for instance, of the more obscure experimental behaviour such as noise output and f.m. distortion. Mr. Hamilton, however, confines himself to well-trodden paths. The best part of the book is the material covering measurements on klystrons, where one has the feeling that the author understands his subject. The theoretical section, on the other hand, is distinctly sketchy and is never tied up with the design problem, resulting in a book which will be of more use to engineers using klystrons than to valve engineers.—A.H.B.

Performance and Design of A.C. Commutator Motors. By E. Openshaw Taylor. Pp. 350; figs. Sir Isaac Pitman & Sons, Ltd., Pitman House, Kingsway, London, W.C.2. Price 45s.

It is interesting to observe an idea develop and come to maturity. About thirty years ago Dr. A. E. Clayton wrote the classic "Performance and Design of D.C. Machines." The publishers saw the possibility of extending the idea to a.c. machines, and the "Performance and Design of A.C. Machines" appeared in 1936. The title in this case was, however, something of an overstatement, because a.c. commutator machines and single-phase induction motors were omitted.

Now, with the present volume, the full range of normal industrial motors is almost completely covered, but not quite, for the rapid growth of automatic control with its drag-cup, two-phase induction and cross-field machines has again produced a small gap between the subject and its covering. The present book deals with a.c. commutator motors and the single-phase induction motor. It does not start from primary elements: an advantage, because readers at this level will already be conversant with the more usual machines. The treatment assumes such prior knowledge, and proceeds with the subject in a thorough and exceptionally logical way.

The scheme has been well thought out. Part I is concerned with the common general problems of windings, m.m.f., e.m.f. and commutation. Commutator machines for a.c. are the most general types electromagnetically, so that all others can be regarded as simplifications. Part II deals with commutator machines auxiliary to an induction motor for the control of speed and power factor, Part III with three-phase commutator motors in their own right, and Part IV with single-phase machines. The treatment is always clear and concise: it outlines the common features of each category, discusses operation with the aid of circuit analysis and locus diagrams, expounds performance and gives notes on design and application. The work is of degree and post-graduate level and is comprehensive except for constructional details and photographic illustrations, the value of which is in any case arguable.

There are few points of adverse criticism. A useful analysis by means of circuit equations based on the two-axis theory, given in Part IV, might have been extended to three-phase machines, although admittedly the advantage is less obvious where transient conditions are not in question. The discussion of brush effects could have been extended, for they can on occasion cause an otherwise useful linear theory to be rejected. There seems to be no good reason to vary units from the M.K.S. system by the introduction, for example, of oz-in or lb-ft when conversion constants have been quoted. Design is not seriously attempted: no doubt it would have stretched the book to an inordinate length. But all these are minor matters, and the overall impression is of clarity and real competence.—M.G.S.

The Principles of Technical Electricity. Third Edition. By M. Nelkon. Pp. 250; figs. Blackie & Son, Ltd., 16/18, William IV Street, Charing Cross, London, W.C.2. Price 15s.

This book was first published in 1946 and the fact that it has reached its third edition is sufficient evidence of its merits. It is intended primarily for telecommunication students preparing for Parts I and II of the City & Guilds of London Institute examinations, and covers d.c. circuits, electrostatics and electromagnetism, single-phase circuits and the basic principles of the diode and triode. The various electrical and magnetic phenomena are dealt with very lucidly, and only a few of the proofs require mathematics beyond simple algebra and trigonometry. In a number of places one finds formulæ introduced without any proof, but it is probably better to omit such derivations for the type of student likely to use this book.

In this edition the rationalised M.K.S. system of units has been adopted, but it is a pity that the author did not take the opportunity to replace some obsolete symbols by their modern equivalents. Also, amendments could well be made to the following points when the next edition is being prepared. The statement concerning current on p. 112 is incorrect since the constant a involves a knowledge of the permeability of free space, and the definition of the unit of mutual inductance on p. 131 is wrong. The expression on pages 135 and 175 for the value of the induced e.m.f. is also wrong—it should refer to the *change* of current per second, and the scales of the instruments shown on p. 164 are incorrectly drawn.

The many problems, with answers, provided at the end of each chapter will be found useful by students starting a study of electricity and magnetism, to whom the book can be recommended.—E.H.

VIEWS on the NEWS

By REFLECTOR

RECENTLY, my readers will recall, the Lord Mayor of Nottingham sent a cheque for £100 to the East Midlands Electricity Board in payment for a refrigerator presented to his wife when he opened a new service centre. He explained that he could not accept gifts of this sort from a nationalised industry. Maybe with this in mind the manager of the Newport District of the South Wales Electricity Board (Mr. I. C. Williams) found it necessary to explain why the Mayor of Newport was presented with an electric clock when he inaugurated the Board's new local showrooms. Mr. Williams is reported by the *Western Mail* to have said that the clock was "an inexpensive token to mark a big occasion and it would be deplorable if the Board were so fettered that it could not make a gesture of this sort on a memorable occasion." Such mementoes have been presented almost from time immemorial and I consider that this practice is much to be preferred to the growing custom of paying large fees to stage and radio "personalities" to perform opening ceremonies.

* * *

Many people seem to believe that overhead lines—from the grid to rural distribution—began with nationalisation of the electricity supply industry although many of them date back years before that. This impression seems to exist even among members of Electricity Consultative Councils for at a recent meeting of the East Midlands Council a member referred to the "clutter of poles" at Alford (Lincs) which spoilt the amenities of the place. Mr. N. F. Marsh, the deputy-chairman of the East Midlands Board, was able to assure the member that these particular poles were erected in 1933 by a small private company. He said it would be a very different story if the Board was doing the job today. While it would be too costly to place the lines underground, the Board would pay special attention to the design and layout of overhead lines supplying rural housing estates.

* * *

At a meeting of the Whitby Rural Council the recent electrocution of nine cows because of a defective earthing system was mentioned. In this case metal pipes had been replaced by plastic ones and one councillor stressed the need for ensuring proper earthing. The *Northern Echo* heads its report "Plastic conduits must be earthed."

* * *

We are constantly being informed of the benefits accruing from the wider use of electricity, and almost as frequently told of the indirect blessings which nearly always arise. Recently I heard of one of the by-products of the Kariba hydro-electric scheme. Much of the land up-stream from the dam site is dense forest and an observer who flew over this tells me that he noticed large patches of bare earth from which the trees had obviously been cleared. Inquiries showed that these areas were to be the new fishing grounds in the 170 mile long lake resulting from the damming of the Zambesi, the last stages of which are now taking place. It is expected that large quantities of fish will be obtained from this new source and as the power station is not a thermal one there will be no complaints that they are being half cooked by discharged cooling water.

* * *

In my 5th December notes I touched upon glow-worms. Mr. A. Wilson, of Maidstone, sends me a copy of a folder issued by his company (Drake & Fletcher, Ltd.) about a year ago in which one of these coleopterous insects is mentioned. An electrical installation had been satisfactorily completed but on Christmas Eve the supervisor was awakened by a messenger from the house. He was told that in the scullery wall there was a small blue light and it was feared that the wiring was defective. The supervisor returned with the messenger and immediately he saw the "blue glow" he produced his knife and prised from the brickwork an enormous glow-worm. Mr. Wilson assures me that though this story may seem "tall" it is nevertheless quite true.

* * *

"Landlady" writes to the *Gloucestershire Echo* saying that the new increase in electricity prices is beyond the means of her tenants and herself—all elderly people who need warmth and are at home all day. She goes on to say:—

> "Because the sub-meters in my house are my own property the Electricity Department [*sic*] will charge me £1 to £1 10s each meter for resetting from the present 5¼d to 5¾d per unit."

It would be interesting to know what "Landlady" pays the Electricity Board per unit.

* * *

Objections to overhead lines, now so frequent, were known seventy years ago. The *Electrical Review* of 28th December, 1888, contained the following report:—

> "At the last meeting of the Bath Town Council Alderman Gibbs moved the adoption of a report from the Surveying Committee, recommending that the seal of the authority be affixed to a contract with Mr. Massingham for the electric lighting of a part of the city. He would, he said, have been glad if they could have dispensed with the posts and overhead wires. Mr. Sturges, in seconding, acknowledged that the friends of the electric light were exceedingly obliged to Alderman Gibbs for the great fairness he had shown in treating the subject in committee. He repressed their ardour, prevented their rushing, and had brought the vessel safely, he hoped, into port. Mr. Heywood wished the committee had seen their way to spend £240, and put the wires underground. He predicted that when they were put up there would be a howl of indignation, and that they would have to put the wires underground at any cost."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. N. J. Chanter, M.Sc., D.I.C., A.R.C.S., A.M.I.E.E., has been appointed manager of the transmitting and microwave division of the Mullard Radio Valve Co., Ltd., and he will be in charge of the Mullard Transmitting and Microwave Valve Production Unit at Waddon, Surrey. For the past twelve years Mr. Chanter has been head of the microwave valve division of the Mullard Research Laboratories, during which period he has been responsible for the development of many new devices and techniques applicable in the fields of radar and communications. He studied physics at the Royal College of Science and before joining the company was engaged in the development of radar systems.

The B.B.C. announces the appointment of **Mr. J. S. Clemo** as engineer-in-charge of the Rosemarkie television and v.h.f. sound broadcasting station in succession to **Mr. M. Clough,** who recently became assistant engineer-in-charge at the high-power station at Holme Moss.

Following the integration of the Witton and Erith Works into a single engineering group under the control of Mr. A. L. G. Lindley, assistant managing director of the General Electric Co., Ltd., the following new appointments are announced:—Witton Engineering Works: **Mr. T. H. Kelsey,** assistant general manager; and **Mr. J. W. Laing,** chief engineer, responsible for the engineering and sales activities of the Rotating Machines, Switchgear, Transformer, Rectifier and Traction Divisions. **Mr. J. S. Cliff** and **Mr. E. Gallizia** have been appointed assistant chief engineers and **Mr. A. E. Taylor** engineering liaison officer between the home branches and Witton and Erith.

Erith Engineering Works: Following the recent appointment of Dr. K. J. Wootton as manager, Atomic Energy Division, **Mr. B. S. Pelton** has been appointed manager, General Engineering Division (which includes mining and materials handling equipment), and **Mr. D. M. Smith,** manager of the Power Plant Division.

Head office, London: **Mr. C. J. O. Garrard** has been appointed manager, Engineering Department, London. His responsibilities will also include the company's engineering activities in Europe. **Mr. E. W. Molesworth** succeeds Mr. Kelsey as personal assistant to Mr. Lindley.

The following have been appointed managers of the Engineering Departments at the main home branches:—Glasgow, **Mr. J. R. Mercer;** Newcastle, **Mr. V. F. Ellison;** Manchester, **Mr. O. S. Chalmers;** and Birmingham, **Mr. W. R. Greves.**

The chairman of the Associated Insurers (British Electricity) Management Committee, Associated Engineering Insurers (British Electricity) Management Committee and British Insurance (Atomic Energy) Committee announces that **Mr. C. G. Pemberton** will retire on pension at the end of this year. Mr. Pemberton has been the secretary of the three Committees since their formation in 1949, 1950 and 1956, respectively, and also served as clerk to the Committee of Associated Fire Insurers (Government Commodities) Management Committee from its inception in 1940 to the time when its activities ceased at 31st December last. **Mr. A. C. Miles,** at present deputy United States manager of the Royal Exchange Group, has been appointed to succeed Mr. Pemberton, and will shortly be returning to this country to take up his duties as secretary of the three Committees on 1st January.

Earlier this month Princess Margaret visited the works of **Rist's Wires & Cables, Ltd.,** at Newcastle-under-Lyme, Staffordshire. The Mayor of Newcastle, Mr. W. E. Welsby, presented Mr. D. A. V. Rist, managing director, to Her Royal Highness, and Mr. Rist, in turn, presented Mrs. Rist and Messrs. F. G. Moon, R. J. Silver, M.B.E. (directors), and their wives. Also presented were other executives of long service. The ceremony was followed by the presentation of a bouquet to Her Royal Highness by the works "queen." During her tour of the factory, Princess Margaret showed great interest in the various aspects of cable manufacture and talked with many of the employees.

Princess Margaret escorted by Mr. D. A. V. Rist (managing director) during her visit to the factory of Rist's Wires & Cables

Mr. C. E. Hind has been appointed sub-area commercial officer, Harrogate Sub-Area, North Eastern Electricity Board. He joined the North Eastern Electric Supply Co., Ltd., in 1930, and served in the lighting, heating and power departments of that company until his transfer to the Harrogate Sub-Area of the Board as senior assistant engineer in the Sub-Area Commercial Officer's Department.

Mr. F. H. Ewens has been appointed chairman of W. Canning & Co., Ltd., in succession to Sir Ernest Canning,

Mr. T. H. Kelsey

Mr. J. W. Laing

Mr. B. S. Pelton

Mr. D. M. Smith

Mr. C. J. O. Garrard

who is resigning from the board as from 31st December owing to advancing years. Sir Ernest has been connected with the business for sixty-six years and has been chairman since 1920. The directors recommend an alteration to the articles of association to permit them to confer on him the honorary title of president. **Mr. W. H. Griffin** has been appointed joint managing director with Mr. Ewens, and **Mr. B. Tromans,** who has been connected with the chemical division for seventeen years, has been elected to the board.

Mr. R. B. Nicholes, A.M.I.R.S.E., has been appointed sales manager of the White Electrical Instrument Co., Ltd. After active service with the Royal Engineers, Mr. Nicholes joined the Westinghouse Brake & Signal Co., Ltd., in 1947, where he was engaged in the design and installation of railway signalling projects. In 1953 he was appointed to the sales staff of Le Carbone (Great Britain), Ltd. In addition to dealing with home and export instrument sales, Mr. Nicholes will be responsible for sales promotion of all the company's products.

Mr. J. S. A. Hodge has been elected chairman of Bennis Combustion, Ltd., **Mr. B. W. Dawkins** has been appointed managing director, and **Mr. C. H. Hereford** has been appointed a director.

Mr. J. G. Craven, M.I.E.E., has been appointed chairman of Green & Smith, Ltd., incorporating Wallis & Watson (Electrical Engineers), Leeds, in succession to the late Mr. J. D. Green, M.I.E.E., and is resigning from the position of joint managing director at the end of the year after forty years' service and fifty-six years in the electrical industry. He will be succeeded by **Mr. J. A. Richardson** (director) who will take over his duties as joint managing director.

Mr. J. G. Craven

Mr. T. Cannon, the sales manager for the Midlands and West of England area of Marconiphone Radio & Television Sales, Ltd., is retiring on 31st December. He is succeeded by **Mr. C. A. Ray.**

Mr. E. M. Butterworth has resigned his position as chief development engineer with Magnetic Devices, Ltd., to take up the position of chief engineer with Besson & Robinson, Ltd., relay manufacturers, of Harlow, Essex. He enters upon his new duties on 1st January.

Mr. D. J. Rawle, assistant divisional electrical engineer for the Durham Division of the National Coal Board since 1957, has been appointed divisional electrical engineer. He succeeds

Mr. A. Newing, a director of Lancashire Dynamo Holdings, Ltd. (left) and Mr. W. R. Baron, sales engineer for Lancashire Dynamo (right), are shown through the El Segundo, California, plant of the International Rectifier Corporation by Mr. W. de Fremery, export sales manager of the Corporation. The two companies have recently signed an agreement establishing the International Rectifier Co. (Great Britain), Ltd. *(see page 1200)*

Mr. C. E. Forster, who has been appointed chief engineer for the North-West Area of the Durham Division.

The **Bristol Electric Club** held a dinner at the Grand Hotel, Bristol, on 12th December. The guests were welcomed by Mr. A. N. Irens, chairman of the South Western Electricity Board. The chairman of the Club, Mr. A. W. Harrison, presented a cheque for £225 to the Electrical Industries Benevolent Association. The toast of the Club was proposed by Comdr. R. Walker.

The annual dinner of the **I.E.E. South Midland Centre** will be held on 6th February at the Grand Hotel, Birmingham. Applications for tickets (members £1 10s each, graduates and students £1 each) should be made by 5th January to Mr. E. H. Cox, hon. secretary, Midlands Electricity Board, Mucklow Hill, Halesowen, near Birmingham.

Mr. W. Kupfer, director of the British General Manufacturing Co., Ltd., is leaving early in January for an extended tour which will include West Africa (Lagos and Accra), South Africa (Johannesburg, Durban and Cape Town), the Central African Federation (Bulawayo and Salisbury) and East Africa (Nairobi and Kampala).

The North Western Branch of the **Electrical Trades' Commercial Travellers' Association** held a party and dance on 12th December at the Heaton Chapel Reform Club, Stockport. A draw was made for prizes and realised about £170; after the deduction of expenses the balance will be given to charity.

Mr. B. Allanson, Blackpool district manager for Hoover, Ltd., has just completed twenty-five years' service with the company and he has been presented with a gold watch by Mr. R. T. Griffiths, general sales manager (home).

Mr. B. Swales has been appointed northern area manager of the Ferguson Division of Thorn Electrical Industries, Ltd., with effect from 1st January. Mr. Swales joined the company in 1956 as representative for the Midlands area. He has been connected with the industry for many years and before joining Ferguson was Midland area manager for Vidor.

We regret that in the caption to the photograph of district managers of the **South Wales Electricity Board** published in our last issue, the names were not in the correct order. The caption should have read as follows:—Back row (left to right): Messrs. E. Broughton, I. C. Williams, J. Harley, A. J. Leather, L. Benallick and W. A. Coggins. Front row: Messrs. F. G. Copland, G. V. Vaughan, W. Davies, R. Lefevre, C. Evans, T. E. Reece, I. G. Evans, B. Jones, G. J. Hughes, H. B. Holloway, A. C. Davies and A. L. Barnett.

OBITUARY

Mr. W. E. Wright.—The death occurred on 11th December of Mr. William Elkington Wright, F.C.S., late director of the Pyrene Co., Ltd., who was responsible, primarily, for the metal finishing division of the organisation. Mr. Wright joined the Pyrene Co. nearly thirty years ago and pioneered in this country the use of phosphate coating processes on a production scale. He had been in failing health for several years and retired from the board of the company at the close of 1957. His knowledge and advice, however, continued to be available to his colleagues.

WILLS

Mr. M. Gueilikman, M.I.Mech.E., M.I.E.E., a director of Sturtevant Engineering Co., Ltd., who died on 22nd September last, left £19,757 gross (£17,878 net).

Mr. W. N. Mann, former director of Panelec (Great Britain), Ltd., who died on 9th August last, left £18,062 gross (£7,144 net).

Mr. D. Inman, electrical and radio wholesaler, late managing director of the Central Pier, Morecambe, who died on 30th December last, left £49,899 gross (£49,111 net).

Mr. E. C. Inston, liaison officer in the United Kingdom for the Electricity Corporation of Nigeria, who died on 24th February last, left £4,462 gross (£3,928 net).

Mr. S. Blackett, assistant commercial engineer for the North Eastern Electricity Board's Redcar District, who died on 9th June last, left £4,530 gross (£3,260 net).

PARLIAMENTARY REPORT

Period Extended for Radiation Claims

To meet objections raised by Opposition peers, Lord Mills, Minister of Power, proposed an amendment to Clause 3 of the Nuclear Installations (Licensing and Insurance) Bill in the House of Lords to alter the time limit for claims in respect of radiation damage or injury arising from a reactor accident from 10 to 30 years. He explained that, since claims presented after 10 years or in excess of £5 million for each occurrence would be an uninsurable risk, it was necessary to make special arrangements to see that the licensee of the installation would be reimbursed.

Lord Silkin, for the Opposition, moved an amendment to delete the time limit altogether but Lords Mills refused to accept this and the Government's amendment was agreed to.

Lord Mills promised to study further an amendment to change the definition of "nuclear reactor" in Clause 1 to make it read "a plant for producing atomic energy by a self-sustained and controlled fission process." In the Bill it is described as "a maintained and controlled fission process."

An Opposition amendment to ensure that established claims for radioactive injury or damage were paid out of Exchequer funds was negatived after Lord Mills had stated that the reactors would be run by commercial undertakings, mainly the Electricity Boards, and the Government saw no reason why they should not be required to insure against the risks involved in the ordinary commercial way.

After the Bill had been given a third reading, Lord Mills said that it was necessary to ensure that anyone who suffered radioactive injury from an accident to a reactor was able to obtain compensation. At present a claim on account of injury or damage by radioactivity against the Electricity Boards could not succeed unless negligence was proved. They would now be required to pay compensation whether they had been negligent or not.

The Bill was passed and will come before the Commons in the New Year.

Nuclear Hazards

Mr. Stan Awbery asked the Minister of Housing and Local Government if he was aware that the construction of a number of nuclear power stations near industrial centres was creating hazards for the population and what steps were being taken to protect the people against these dangers.

Mr. Henry Brooke said he did not accept the implications in the question about danger. The nuclear power stations being built for the commercial production of electricity were not sited close to centres of population. They were of inherently safe design, and would present no more hazard to people living nearby than many existing industrial works. The discharges of radioactive material would be very small, and would be carefully controlled.

Sir Alfred Bossom asked the Minister of Agriculture "since it has been officially announced by the chief planning engineer of the Central Electricity Generating Board that no assurance can be given that there will not be danger from radioactive dust emitted from the proposed new nuclear power station at Dungeness," how far provision had been made to safeguard the health of the population.

Mr. Hare said that the Nuclear Installations (Licensing and Insurance) Bill provided that no radioactive wastes—whether airborne, solid or waterborne—should be discharged from any nuclear power station except in accordance with authorisations given by the Minister of Housing and Local Government and himself. Authorisations would be granted only if they were satisfied beyond doubt on independent scientific advice that the proposed discharges could not harm people or livestock in the neighbourhood through contamination of crops, water supply or otherwise.

Atomic Power Programme

Mr. Mason asked how many atomic power stations were to be built within the re-phased programme, and to what extent the reduction in number would affect the building companies concerned.

Sir Ian Horobin said it now seemed likely that the programme could be fulfilled with fourteen or fewer stations. He had no reason to believe that the nuclear power consortia were adversely affected by an achievement to which they had largely contributed.

Oil-Burning Power Stations

Mr. Robens asked the Paymaster General if he would give the names of the coal-burning power stations currently being converted to the use of oil, the total amount of coal equivalent in which oil would displace coal at these power stations and the length of the oil contract in each case. He also asked for the names of coal-burning power stations now converted to oil, the total annual amount of coal equivalent involved and the length in each case of the oil contract.

In reply to Mr. Robens, Sir Ian Horobin gave the following information:—Coal-burning stations in the process of conversion to oil: Barking "C," Poole, Plymouth "B," Portishead "B" (in part), Brunswick Wharf and Littlebrook "B." Coal-burning stations already converted to oil: Tilbury, Littlebrook "C," Bromborough and Ince. He said that the oil consumption of these stations would depend on operational requirements and a number of other factors, but it was estimated that, during the next few years, it was likely to be of the order of 2¼ million tons of coal equivalent per annum by each group. In no case did the existing contract expire within the next eight years.

Capital Investment in Rural Electrification

Mr. Hayman asked the Paymaster General whether he had now reviewed the investment in the electricity industry in relation to the restoration of cuts in the capital allocations for rural electrification to Area Electricity Boards.

Sir Ian Horobin said Area Boards had been authorised to undertake some additional work on distribution systems, including rural electrification, and this was being put in hand at once.

Euratom Discussions

The Prime Minister, Mr. Harold Macmillan, was unable to give further information on the subject of the proposed agreement for the exchange of technical information between the United Kingdom and Euratom. It is understood that the representatives of Euratom have asked for a reconsideration of one of the articles in the agreement, and the signing—which was expected to take place early last week—has been delayed because it was necessary to reopen negotiations.

Motorway Lighting

Mr. Janner asked the Minister of Transport what was the cost of erecting and removing about 100 lamp standards at the two-level intersection of the Preston motorway with the A.59 road.

Mr. Harold Watkinson replied that this lighting scheme was installed in accordance with the general policy for trunk roads, but subsequently he came to the conclusion that it was preferable to experiment initially with no lighting on the motorway, and to give further consideration to what policy should be adopted for the future. This was in hand in collaboration with the Road Research Laboratory. The lamp standards would be used elsewhere and the cost of erecting and removing them was about £5,800.

B.T.C. Investment

Mr. Harold Watkinson, Minister of Transport, told Mr. E. Davies that the total of the British Transport Commission's investment for 1959 would be rather more than £200 million and over £170 million of this would go to the railways.

INDUSTRY AND THE HOUSE

Coal Supply and Demand

By A. M. F. PALMER, A.M.I.E.E., M.Inst.F., M.P.

AN important industrial debate in the House since I last wrote has been on the new borrowing powers order required by the National Coal Board. This puts £130 million as the total amount which coal mining can borrow in place of the £75 million permitted hitherto.

Before the debate it was being said that Mr. Nabarro and his friends on the Conservative back benches would want to know the reason why before allowing the order to go through. As it turned out, the debate was one of the quietest I can remember. Mr. Nabarro's own speech was not very penetrating. His only novel proposal was that the nationalised industries should have a comptroller general to pry into them and check instances of alleged extravagance. But as it happened he had started his speech by demanding to be told whether the Coal Board was to be run as a social welfare club or a commercial organisation and commercial organisations don't usually have comptroller generals.

The debate was opened by Sir Ian Horobin, the Parliamentary Secretary to the Ministry, and a former ally of Mr. Nabarro. In his new position he pointed out a number of facts favourable to the reputation of the Coal Board; for instance, that output per man shift was now running at the record rate of 26 cwt. The probable revenue loss in 1958 would not be very different from the £5 million of last year which, considering all the difficulties, Sir Ian thought might have been worse. It was true that the N.C.B. had been much assisted in its financial affairs by an income tax windfall and anyone who could get money out of the Inland Revenue without going to prison was "a friend of his." This rather unministerial remark brought loud whistles of surprise from the Opposition. Mr. Robens jumped in to point out that the rebate could not be regarded as "pennies from heaven." The excess of money which had been paid to the income tax people had contributed to the past deficit of the coal industry.

Stock Position

In a first reference to the situation which overshadowed the remainder of the debate, Sir Ian did not think that any just criticism could be made of the Board for having failed to take steps earlier to meet changed conditions. Neither did he think the Government could be criticised for slowness in changing course. No change could have been possible before the first half of 1957 and drastic steps were taken in the winter of 1957-58. Coal stocks now amounted to about four weeks' undistributed production. This was less than those held by the European Coal and Steel Community and less than half that of British stocks of rubber, tin and cotton. Sir Ian suggested the country had become used to living from hand to mouth with coal; hence people took an unbalanced attitude when we accumulated a few weeks' surplus.

The increase in coal prices had had a great deal to do with the alteration in demand he thought. Deliveries of house coal in the London area in the last four years had fallen by about one-third. People would no longer buy coal at any price and were choosing other energy sources. On the most careful estimate that could be made about prospects for 1959 the demand would be about 200 million tons. At the present output rate total production would be 209 million tons. For future policy there should be three assumed conditions: that the financial and competitive conditions of the industry could be improved; that the industry should not drop output to such an extent as to make it difficult to expand again; that as far as possible changes should be made with the minimum of social disturbance. Finally, the Parliamentary Secretary thought that it would be wrong now to expect the demand for coal to go up to the higher figure envisaged in the last development programme. Future emphasis must be on productivity and not production.

Opposition Views

After announcing that the Opposition approved the extra borrowing needed Mr. Alfred Robens said that it was the new pattern of energy demand which interested the Labour Party. One of the reasons for the present coal situation was certainly the competition of oil; nobody had allowed sufficiently for the striking increase in oil consumption when long-term plans were being made. But nevertheless, went on Mr. Robens, in the view of the Opposition the main responsibility for the present surplus had to be placed at the door of the Government. Industrial stagnation had reduced the need for coal. He did not accept the glib view that miners' wages had priced coal out of the market. The British miner was still giving Britain the cheapest coal in Europe.

The Labour Party did not object to oil competing with coal, but felt that competition should be on a fair basis. Because of ministerial control of prices the N.C.B. was fighting the oil companies with one hand tied behind its back. The oil companies could go anywhere they liked and give discounts any time they liked to suit themselves, but coal could not do this.

After a useful debate in which many practical suggestions for making better use of the country's indigenous fuel were made, Mr. Harold Neal wound up for the Opposition and Mr. Reginald Maudling, the Paymaster General, spoke finally for the Government. Mr. Neal said he did not wish to be accused of spreading alarm and despondency, but he would be insincere if he encouraged anybody to hope for a quick recovery of the coal industry. There had been complaints for a long time that the average age of miners was rising which, in the end, was bound to have an effect on productivity. Protesting against opencast working, Mr. Neal could think of nothing more calculated to exacerbate the feelings of a miner on unemployment pay than to see his pit closed while opencast mining went on in the adjoining fields.

Mr. Maudling contended that the Opposition slogan of a "national fuel policy" concealed a great deal of mental mystification and muddle. Discussions had already taken place in order to reduce oil deliveries to power stations. The oil industry had been very co-operative, and to go further would be unfair. The Opposition should tell the House whether they would really put a tax on oil to discourage its use. He agreed that the Coal Board, because of its statutory obligations,

was possibly inhibited in the matter of commercial freedom. This was something which the Government was studying and any proposals brought forward would receive their sympathetic consideration. The Coal Board must in the meantime concentrate as much of its production as possible at efficient mines and improve at the same time, even further, output per man shift.

When we resume after the Christmas recess we shall have debates on the Nuclear Installations (Licensing Insurance) Bill and on the new Electricity (Borrowing Powers) Bill just published. These will both be complementary to the coal debate just described. In other directions unemployment is an important domestic talking point.

Labour members have staged several demonstrations against mounting unemployment by barrages at question time and there is to be a major debate on the more general aspects of the situation. The Government are coming to realise that in combating the mounting prices which were losing them support a couple of years ago they have now brought about a degree of unemployment which won't win them many medals either. But that is one of the troubles about politics: if it's not one thing, it's always another.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Hire-Purchase and Inflation

CONTRARY to what Mr. J. E. S. Simon, Financial Secretary to the Treasury, said at the Electrical Industries Club, hire-purchase cannot cause inflation. When someone buys, for example, a television set by easy instalments, the deposit and subsequent payments are paid with money they have earned by producing other goods, the money outstanding covering that portion of the set belonging to the vendor.

In other words, hire-purchase is a method whereby retailers can lend their stock as a means of capital investment instead of leaving it idle on their shelves. Naturally, interest is paid on this capital by the hire-purchaser.

Unless the price charged for the set is higher than it should be by virtue of an excess of currency which does not represent its real exchange value, there cannot be inflation.

Therefore we must assume that the cause of inflation does not rest with the sale of goods, whatever kind of transaction is adopted, but depends entirely on a sound and honest currency.

Sidcup, Kent. STEPHEN MARTIN.

An Architect's Approach to Floor Warming

I HAVE only two points to make on Mr. S. A. Williams's letter of 12th December, and the first concerns my choice of a block of flats for the cost example. I think that Mr. Williams has only read my correspondence after the article or surely he would have noticed that right at the beginning I said that under-floor heating systems were not equally suitable for all types of buildings. Therefore, this means that for some buildings they are less suitable, and although I quoted a church, it is obviously true that an office or school which is only occupied for a few hours each day will be wasting the even temperature gradient which has been provided, and that even at a reduced tariff this could result in excessive running costs for the useful heat obtained.

In conclusion, I did say that in the short term—that is considering capital cost—under-floor heating systems would be cheaper (although this will, I agree, probably also apply to other electrical schemes using convectors or radiant heaters), and in the very long run the electrical storage systems will again be the most economical.

The period in between is the critical one, and the speed with which nuclear stations come into operation, or nuclear power becomes more widely available will, I think, determine the length of this critical period. As I understand it, whilst solid fuel generating stations are less expensive to construct, but more expensive to run, they are capable of being shut down at night, whereas nuclear stations are more expensive to construct, are far cheaper to run, and *cannot* be shut down in off-peak periods.

These factors I anticipate will induce the Electricity Boards to offer even more favourable rates for off-peak loads, or, conversely, ever more expensive tariffs for peak periods, so that it is not merely the whim of Area Boards which controls the tariffs offered; there is a fundamental factor which governs this, and this would seem to operate against water storage systems.

Lee, S.E.12. R. B. HELLARD.

Tests on a Washer

WE, also, were completely convinced of Mr. Fraser's sincerity. After meeting him several times, we know that he believes, honestly, in the effectiveness of the " Merlin " sonic washer. The difference between us is entirely one of attitude to facts.

In *Which?* No. 4 we reported that we had found, by controlling washing tests, that the " Merlin " sonic washer had " no significant washing effect." Mr. Fraser said that housewives put dirty clothes with the washer into detergent and hot water, left them for 20 minutes and the clothes came out cleaner. We said " Of course they do. So do clothes put into detergent and hot water and left for 20 minutes *without* the washer." To satisfy us both, we provided two equally soiled pieces of material, put piece " A " (with other clothes) into a sink with hot water, detergent and a sonic washer, and piece " B " (with other clothes) into a sink of hot water, detergent and no washer. Each was left for 20 minutes, taken out, dried and ironed. We could see virtually no difference between the two pieces and the laboratory test showed a minute difference in favour of the " Merlin "-washed piece.

We then asked 51 women to give their views. As Mr. Fraser said, 51 per cent said the " Merlin "-washed piece was cleaner, but 24 per cent said the other piece was, and 25 per cent saw no difference. The test confirmed our previous opinion that the " Merlin's " washing effectiveness was " not significant."

Mr. Fraser relies on his facts—the opinion of housewives that clothes are cleaner or whiter washed with a " Merlin " washer. Cleaner than what? The housewives do not have the opportunity of comparing clothes

soaked in detergent and hot water, and clothes soaked in detergent and hot water and with a sonic washer in the sink. Until they have, they are not in a position to say how much the washer adds to the washing of the clothes washed.

London, W.C.1. EIRLYS ROBERTS,
Editor, *Which?*
(Consumers' Association, Ltd.).

Mr. B. M. Turk raises a number of interesting points in reply to my letter published in your issue of 28th November. In my view they have already been answered in my letter but, if I may, I will reiterate them here. He states that I do not say what results are claimed for the "Merlin" sonic washer. In my second paragraph I stated, *inter alia,*

> "using materials soiled in the normal way there is no doubt whatsoever in the mind of the public to whom the 'Merlin' washer was demonstrated . . . that the washer is a very effective machine indeed."

Your correspondent deduces from my letter that the two test pieces (one "Merlin" washed, the other soak washed) were soiled to *my* satisfaction and not with a solution to the standard of the B.L.R.A. In fact, the latter was the case and I would repeat my contention that this special solution did not truly represent the everyday soiling problems met by housewives. In fact again I would repeat that where normally soiled material was used, the many housewives who witnessed the demonstrations expressed their complete satisfaction.

In brief, the actual user-reaction is satisfactory, and even academically styled tests disclosed a majority of satisfied witnesses.

Mr. Turk does say that he is in no way connected with the sale or manufacture of washing machines, but my statement is surely reasonably clear.

London, S.W.1. J. A. FRASER,
Managing Director,
New Day Electric (Sales), Ltd.

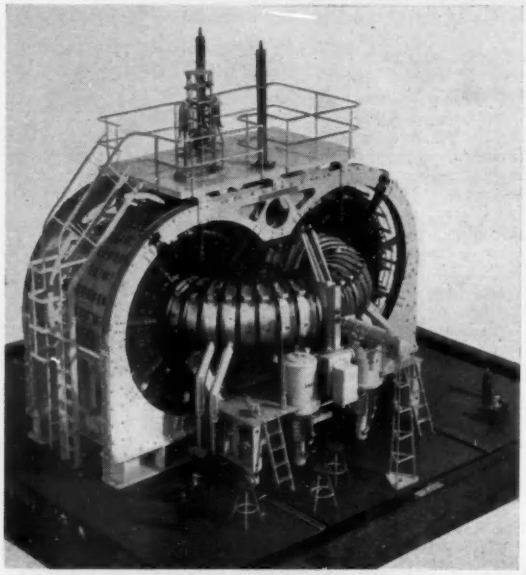
Thermonuclear Exhibition

A SMALL exhibition at the Science Museum, London, illustrating British research into controlled fusion was recently opened. Although the exhibition closes at the end of March next year a detailed 1/24 scale model of ZETA will be included in the permanent physics exhibition.

The centrepiece is a one-third scale model of the ZETA fusion apparatus in which temperatures of several million degrees were obtained in electrical discharges through heavy hydrogen gas. In ZETA this discharge was held stable for a whole millisecond. The model on show was first seen at the Geneva exhibition last September.

A two-thirds scale model of the somewhat smaller apparatus known as Sceptre III, which was on show at the Brussels World Fair, is also included in the exhibition. Sceptre III was developed by Associated Electrical Industries, Ltd.

Examples are also shown of pioneer apparatus used by Ware in London and by Thoneman in Oxford at the beginning of this type of research in 1947. The exhibition also includes a half of one of the early tori actually used at Harwell.



1/24 scale model of ZETA which will be included in the permanent exhibition at the Science Museum

Amendments to I.E.E. Wiring Regulations

THE Wiring Regulations Committee of the Institution of Electrical Engineers has recently had under consideration representations by interested bodies who inquired whether an appropriately designed unit could be safely used to give a supply to an electric dry shaver, notwithstanding the requirements of Regulation 405(C), in a room containing a fixed bath. Particular importance was attached to the convenience of visitors from overseas who were accustomed to a facility of this kind in hotel rooms and elsewhere.

Following a report by a special panel appointed by the chairman to consider the question, the Committee requested the British Standards Institution to prepare a draft British Standard for supply units for electric dry shavers and specified certain characteristics which they regarded as essential to safety in such units. This Standard has now been published as B.S. 3052.

The Council of the Institution has authorised the promulgation of the Thirteenth Edition of the Regulations with amendments effective from 15th December, 1958. The amendments recognise, by an exemption to Regulations 405(B) and (C), the use in bathrooms of shaver supply units complying with B.S. 3052 and installed in conformity with the Regulations.

The amendments also incorporate a revised Regulation 507 and Note—"Test of Effectiveness of Earthing"; other amendments, generally of a minor character, have been included.

Copies of the Thirteenth Edition with 1958 amendments may be obtained from the Institution, price 6s bound in paper or 8s 6d bound in cloth. Copies of the amendments are available separately at 1s 6d.

Fusion of Heavy Hydrogen

ON 12th December an evening discourse was given at the Royal Institution in London by Dr. T. E. Allibone (director, A.E.I. Research Laboratory). He said that many scientists in different countries were now endeavouring to raise the temperature of deuterium gas to very high values, so that fusion of the nuclei might take place. To achieve the release of more nuclear energy than the energy fed into a "fusion reactor" would need a temperature of about one hundred million degrees and in a very general way scientists could see how this might be achieved.

However, the status of research in many laboratories, as revealed at the recent Geneva Conference, was that volumes of gas could be heated in a variety of ways to such a state that D-D reactions occurred, and neutrons and protons copiously emitted by the reactions had been detected. It was possible for some nuclei to be given energy far greater than the mean energy of the gas, and as the efficiency of the D-D reaction rose very steeply with the energy of the D nuclei only a minute fraction of the ions might be responsible for all the observed D-D reaction products. The reasons for the instabilities which gave rise to these energetic nuclei were being studied intensively. We needed to know more about the way energy was being lost from the plasma before we could say whether such loss could be prevented. The fact remained, however, that the amount of energy fed into some discharges at the present time was sufficient to raise them to far higher temperatures than had been measured.

In his lecture Dr. Allibone briefly reviewed the state of fusion research in the United States, the Soviet Union and the United Kingdom. Some of the points of approach were demonstrated by experiment, some were shown with the aid of films, and in the library a few "museum" pieces of apparatus from the A.E.I. Research Laboratory, Aldermaston, were displayed, as well as detailed descriptions of the "pinch effect" approach to the fusion problem.

Area Electricity Board Changes

THE Minister of Power has made the following appointments to Electricity Boards with effect from 1st January:

London: Mr. C. G. Moss, Associate I.E.E., management officer for South East London, is to undertake the duties of Board membership whilst continuing to serve as a full-time officer of the Board.

Eastern: Mr. C. C. Hill, B.Sc.(Eng.), M.I.E.E., M.I.Mech.E., chief engineer of the Board, will undertake the duties of Board membership whilst continuing to serve as a full-time officer.

North Western: Mr. F. Lindley, M.I.E.E., A.M.C.T., manager of the No. 1 (Manchester) Sub-Area of the Board, will undertake the duties of Board membership whilst continuing to serve as a full-time officer.

East Midlands: Mr. W. H. Stokes, C.B.E., J.P., Coventry, has been appointed a part-time member of the Board. He is personnel manager for Armstrong Siddeley Motors, Ltd.

The following part-time members of Electricity Boards have been re-appointed:—**London**: Mrs. G. H. Dunbar, O.B.E.; **South Western**: Mr. J. Tristram Beresford; **South Wales**: Mr. B. Curran, O.B.E.; **Merseyside and North Wales**: Mr. J. A. Duncan, B.Sc.

Part-time members of Electricity Boards who will retire on 31st December on completion of their terms of office are as follows:—**London**: Dr. P. Dunsheath, C.B.E., M.A., M.I.C.E., M.I.E.E., and Sir George Gater, G.C.M.G.; **South Western**: Ald. H. M. Medland, J.P.; **Eastern**: Sir Cecil Oakes, C.B.E.; **South Wales**: Mr. R. James, O.B.E.; **North Western**: Mr. H. E. Rhodes, J.P.; **East Midlands**: Ald. B. H. Gardner and Ald. A. Sturgess, O.B.E., J.P.

D.S.I.R.'s Second Five-Year Plan

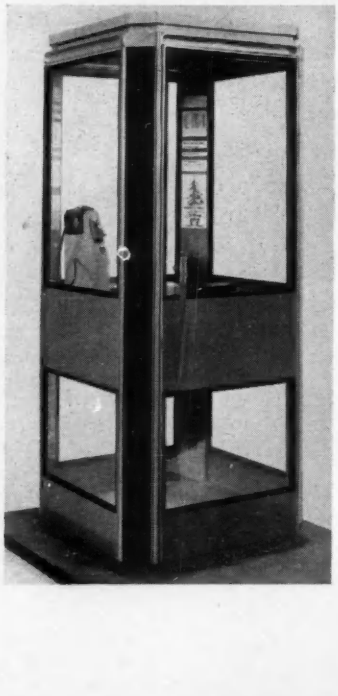
SOME years ago it was decided to adopt an experiment of financing the Department of Scientific and Industrial Research on a five-year basis. The experiment has proved successful, and the Government has decided to repeat it for a further five years. Expenditure on research by the D.S.I.R. will be nearly doubled in the next five years. Under its second five-year plan, for the period 1959-64, approximately £61 million will be made available to the Department, compared with £36 million for the first quinquennium which ends on 31st March, 1959.

The largest expansion is planned to take place in the field of scientific grants to the universities. Post-graduate awards to the students will be increased by about 10 per cent each year until in 1963-64, it is hoped, some 3,800 students will be receiving grants and support for special research will operate on a scale of about £1¾ million per annum. Grants to the research associations will also be increased to over £2 million per annum by the end of the period. It has also been decided to devote much more attention and money to ensure that the results of scientific research are known and applied. It is also proposed that the Ministry of Works will increase its rate of expenditure on behalf of the D.S.I.R. so as to provide buildings and equipment for increased staff in the D.S.I.R. laboratories.

STD Telephone Kiosks

THE Post Office is to experiment with a more modern design of telephone kiosk designed to take the new trunk dialling coin box which was described in the *Electrical Review* of 13th June last. In accepting the design of Mr. Neville Conder, the Postmaster General has had the advice of the Royal Fine Art Commission, the Royal Fine Art Commission for Scotland and the Council of Industrial Design. The accepted design requires further development in detail before a full-scale kiosk can be produced and there is no intention of replacing existing kiosks by this design.

The main structure of the kiosk is of anodised aluminium while the present design, by Sir Giles Gilbert Scott, is of cast iron.



New type of telephone kiosk designed to take the new trunk dialling coin box

General view of the mill bay showing mill stands on the left and control pulpits on the right

Steel Strip Production

NEW MEDIUM-WIDTH HOT MILL INSTALLED BY STEEL, PEECH & TOZER

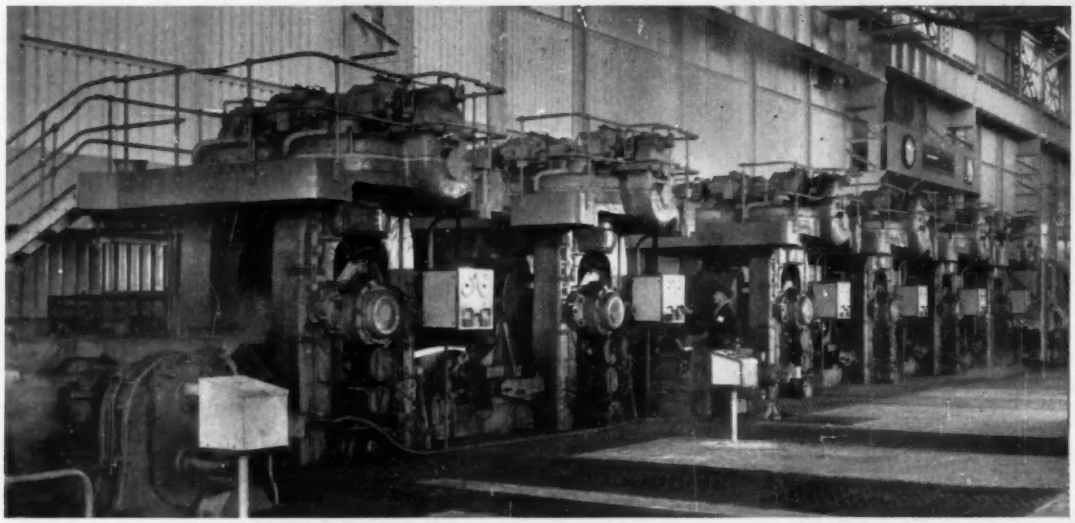
The demand for steel sheet, plate and strip has been much greater than for other steel products and to keep pace with it and also cater for possible future requirements, Steel, Peech & Tozer, Ltd., have invested £4 million in building the new Brinsworth mill described in this article. This is a high-production continuous hot mill for rolling 28ft 3in long by 3in thick slabs into strip up to 18in wide and down to 0·043in thick

HOT rolled strip has been produced at the works of Steel, Peech & Tozer, Ltd., for many years, but the maximum width which can be rolled is 9in and site limitations make it impossible to extend the plant to cater for larger sizes. In view of this it was decided to build a completely new and highly mechanised continuous hot strip mill capable of rolling mild, carbon and special steels up to 18in wide, thus bridging the gap between the outputs of the narrow and wide strip mills now operating in this country.

The Loewy mill which was selected will have an ultimate capacity of about 8,000 tons per week, and its design is such that it will set new standards for close tolerances and surface finish. It produces strip 4in to 18in wide and 0·043in to 0·25in thick, rolled from slabs 28ft 3in long and 3in thick to give a coil weight of 285 lb/in of width. The Brinsworth mill, as it is known, was commissioned about twelve months ago and when we visited Rotherham last week we saw this £4 million plant in operation. It is interesting to note, by the way, that nearly half the cost of this plant is represented by electrical equipment.

The raw material for the works is steel slabs which are delivered by rail from the company's Templeborough works. From the slab bay, which is at one end of the works, slabs are placed on the grid of a depiler, which incorporates a 30-ton weighing machine. The depiler is mid-way between the two reheating furnaces, the slabs being fed singly on to either of two furnace charging roller tables. The 60ft long, oil-fired, reheating furnaces are each capable of heating 75 tons of slabs per hour. They are of the end charging and discharging type, the slabs being pushed through the heating zones by means of electrically-operated twin pushers. A 135ft long live roller table, extending across the discharge end of the two furnaces, takes slabs to the first section of the mill, consisting of a horizontal edging and scale-breaking stand. The horizontal edger is equipped with manipulators on the ingoing side to turn the slabs on edge, while further manipulators on the outgoing side turn the slabs back ready for entry into the first roughing stand.

The roughing train comprises four two-high mills having 21in diameter rolls of 24in barrel length. Preceding No. 3 rougher, there is a 26in vertical edging stand. Between stands Nos. 1 and 2 there is a free run of 38ft with a 63ft run between stands Nos. 2 and 3. Stands Nos. 3 and 4 are close-coupled. From the roughing mill, the stock travels along a 150ft long delay table before passing a rotary flying shear, which can be used for either end trimming or emergency shearing in the event of "cobbles" in the finishing train. The finishing train of the strip mill has six four-high rolling mill stands and two vertical edgers. Each of the six finishing stands has 14in diameter work rolls and 23in



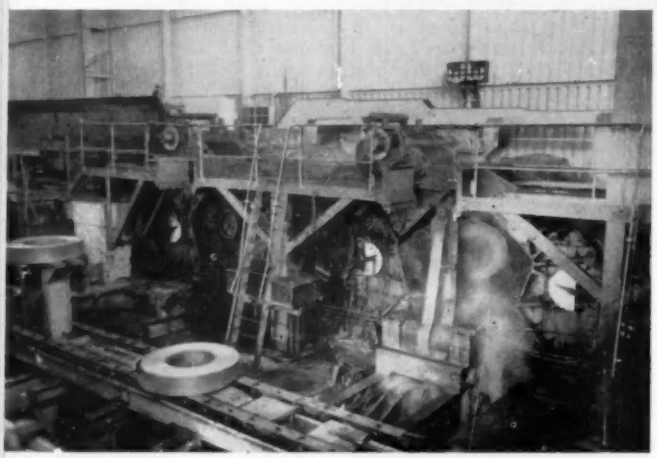
The finishing train has six four-high rolling mill stands and two vertical edgers

diameter back-up rolls, all being of 23in barrel length. By the time the strip reaches the last finishing stand, it is travelling at up to 3,000 ft/min and proceeds along a 160ft cooling table where a bank of water sprays can be used if cooling is required. Next, the strip is coiled on either of two 20in diameter horizontal down-coilers. Completed coils are ejected from the coiler drum and placed on a conveyor for onward transmission to the coil storage and dispatch bay.

Electrical power for the mill is supplied in bulk from the Yorkshire Electricity Board's Templeborough sub-station to a 13-panel, 11 kV, 250 MVA compound-filled metalclad switchboard. This is situated in an enclosed switchroom near the centre of the motor room, which runs alongside the mill stands.

Adjacent to the switchroom is the rectifier house, which accommodates 9 MW of grid-controlled rectifiers, giving a 360/600 V variable-voltage d.c. supply and a 1,000 kW 230 V d.c. supply for general power for overhead cranes and auxiliaries. All the rectifiers are of cubicle construction, sealed steel tank multi-anode mercury arc type, with automatically controlled ventilation.

The strip is coiled on either of two 20in diameter horizontal down-coilers, each having a collapsing mandrel and nine driven guide rollers



Power transformers of 15 MVA total capacity are installed in open-fronted compartments at basement level below the switch and rectifier rooms, and are of the outdoor type fitted with conservators and Buchholz protection. Three of the transformers feeding grid-controlled rectifiers are provided with 22 steps of on-load tap-changing.

The variable-voltage rectifier transformers give 3/12 phase and the constant-voltage units 3/6 phase conversion, but by suitably arranged phase displacement, the rectifier group as a whole operates an equivalent 24-phase network. The a.c. power transformers are duplicated, two 2 MVA units feeding a 13-panel 3·3 kV cubicle type metalclad switchboard, and two 1 MVA units feeding a 13-panel 415 V oil-immersed draw-out l.v. switchboard, for control of, or distribution to, medium and small power auxiliaries.

Roughing Mill Drive

As the slabs enter the mill train from the furnaces, the pass time, or period during which the hot metal is within the rolls, is relatively small, and it was found practicable to absorb the peak rolling loads by flywheel action. It was thus decided to use for the first pair of stand drives (horizontal edging and No. 1 roughing respectively) the simple form of self-ventilated slip-ring induction motor assisted by flywheel. Each of the two motors is designed for 10 per cent slip control by a combined liquid type starter/regulator, and is directly connected to the 3·3 kV switchboard. The machines are rated at 350 h.p. and 700 h.p. respectively at a normal slip speed of 490 r.p.m.

The second and third roughing stands are driven by 1,200 h.p., 428 r.p.m. constant speed self-ventilated synchronous induction motors, each with its own direct-coupled exciter. The motors are reactor started. They are directly controlled from the 11 kV switchboard, and have automatic control of excitation to give unity power factor independent of load, thus obtaining overall

correction of the system power factor. This is achieved by magnetic amplifiers which buck or boost the exciter fields.

The roughing mill stands are so spaced that the hot metal in process of rolling is clear of one stand before it enters the next, but when the slab leaves No. 3 stand a continuance of this procedure becomes impracticable. Nos. 3 and 4 stands are thus close coupled, and to provide control of load without stretching the material, No. 4 roughing stand is driven by a 1,200 h.p. forced ventilated d.c. motor designed for a base speed of 425 r.p.m. with 2:1 speed control by field weakening, and fed from a 1,000 kW bank of grid-controlled rectifiers.

No. 4 stand motor is started by phase shift control of the rectifier grids, and acceleration from base to full speed is arranged under current limit control by motorised rheostat. Starting is performed from the motor room, with permissive control from the mill pulpit. Thereafter, speed adjustment is in the hands of the pulpit operator, and speed matching between stands Nos. 3 and 4 is achieved by using the motorised rheostat in the field of No. 4 stand motor. The control system incorporates magnetic amplifiers.

As already mentioned, a vertical edging mill is inserted between Nos. 2 and 3 stands. This is driven by a 150 h.p., 460 r.p.m. totally enclosed mill type d.c. motor, fed from the constant voltage (230 V) rectifier supply, and provided with 2:1 speed control by field weakening for purposes of speed matching with its neighbouring constant speed drives.

Rotary Shear

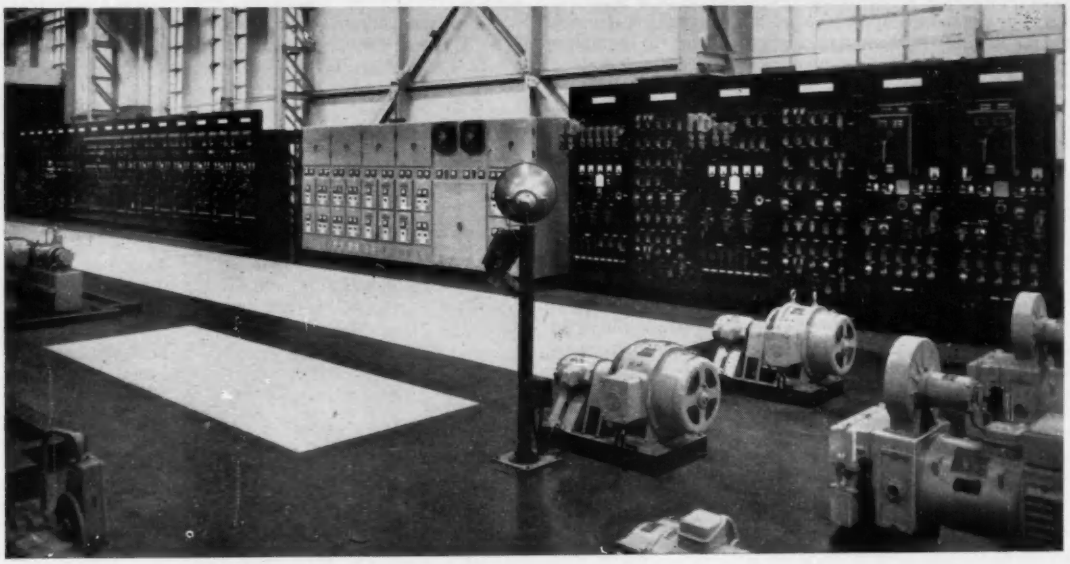
Interposed between the roughing and finishing trains, which are spaced nearly 200ft apart in conjunction with the appropriate roller tables, is a rotary flying shear. This is driven by a 300 h.p. totally enclosed mill type d.c. motor arranged for speed control from 0 to 900 r.p.m. by armature voltage. It is fed from a Ward-Leonard set comprising a 360 h.p., 3·3 kV direct-on-line started squirrel-cage motor, direct coupled to two 230 V self-ventilated d.c. generators connected in series.

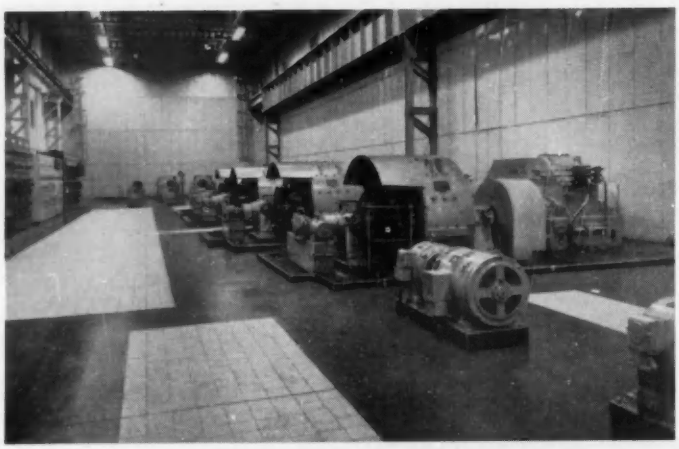
The Ward-Leonard set is started from the motor room, after which the shear motor is under the control of the appropriate pulpit operator, whose control desk has provision for independent cropping of ends, stationary cutting of stock, or for continuous cutting of moving material. For the last mentioned, the shear speed is roughly matched to the speed of the stock, with control reference obtained by a rheostat so calibrated that its values are proportional to the speed of No. 4 roughing stand or from a pilot exciter coupled to No. 1 finishing stand. The control system incorporates a 400 c/s magnetic amplifier.

The finishing train, comprising six main stands and two vertical edgers, handles hot strip at an incoming speed of about 300 ft/min. After the thickness reductions have taken place, the strip is discharged at speeds up to 3,000 ft/min depending upon the width and thick-

General view of the motor room from the roughing stands end

Electrical control panels for the finishing mill stands and down-coilers





Motor room, showing four of the six drives for the finishing mill

ness involved. The stands are arranged in tandem formation and precision speed matching is essential.

Both Nos. 1 and 6 stand motors are rated at 1,200 h.p. with a speed range of 425 to 850 r.p.m., and for reasons of interchangeability are duplicates of the drive motor for No. 4 roughing mill. Nos. 2, 3, 4 and 5 stand motors are all designed for an output of 1,750 h.p. with a speed range of 357 to 760 r.p.m. All six machines are forced-ventilated compound-wound d.c. motors. They are fed from two banks of grid-controlled rectifiers, each of 3,500 kW capacity, and are controlled from a three-operator mill pulpit. The motors can be run either in two groups of three, or in a single group with both rectifier banks interconnected.

The two edging mills are driven by 75 h.p. totally enclosed mill type d.c. motors with a speed range of 515 to 1,030 r.p.m. and are designed with matching characteristics to run with the main drives off the common rectifier supply. The first edging mill immediately precedes No. 1 finishing stand and the second is situated between Nos. 2 and 3 stands.

Rolling can be completed at Nos. 3, 4, 5 or 6 finishing stands depending upon the rolling schedules, having regard to the width reduction required and the outgoing strip speed. A variable voltage from the rectifier supply is provided for starting-up and for trial runs at the minimum 360 V, but normal rolling is carried out at, or near to, the maximum 600 V to achieve a high operating power factor. The selected stands of the finishing mill line start-up and accelerate simultaneously under preset field conditions and thereafter speed adjustment of each stand is obtained by motorised rheostat. The operating speed of the mill train is then held constant by means of a pilot exciter, coupled to each main motor, in conjunction with magnetic amplifier control.

Steady voltage from each of the rectifier banks is maintained by magnetic amplifiers feeding into the grid control circuits, and automatic on-load tap changing ensures that, for a given set of operating conditions, the amount of grid control is kept to the minimum. Manual overall control of transformer tap changing is also made available to the motor room attendant, who has the responsibility of ensuring that, for a given rolling programme, the rectifier plant is working at optimum power factor.

The drive motors for the two sets of coiler equipment are situated in the mill bay, and are controlled from a separate two-operator air-conditioned pulpit. Each equipment includes a 175 h.p. forced-ventilated shunt-wound d.c. motor for driving the coiler mandrel. It has speed control from zero to base speed (700 r.p.m.) by armature voltage, and to top speed (1,620 r.p.m.) by field weakening.

For driving the coiler mandrel there is a similar motor rated at 80 h.p. with speed range of 0/222 to 1,000 r.p.m. for the pinch rolls, and a set of five small a.c. motors driving pairs of individual guide rollers.

The d.c. motors are fed from two Ward-Leonard sets in the motor house, each comprising a 250 h.p. salient-pole self-ventilated 1,000 r.p.m. synchronous motor designed for unity power factor at full load, direct coupled to a 160 kW 0/350 V separately excited shunt-wound generator, with a small exciter for the synchronous machine.

Strip enters the pinch roll of the mill and is deflected on to the corresponding coiler mandrel. The guide rollers hold the first few turns in position while the coiler mandrel is expanded by hydraulic action to grip the coil. Tension is developed between the No. 6 finishing stand and the mandrel for most of the coiling period, but when the tail-end leaves the finishing train, the pinch rolls take over the tensioning using the drive motor as a drag generator.

The coiler mandrel and pinch roll motors start up simultaneously by voltage control from the Ward-Leonard generator. The voltage output is controlled in relation to strip speed, by reference signal from a choice of pilot exciters coupled to Nos. 3, 4, 5 and 6 finishing stands and the necessary precision adjustment of tension independent of coil diameter is obtained by the use of magnetic amplifier control in conjunction with a motorised "follow-on" rheostat.

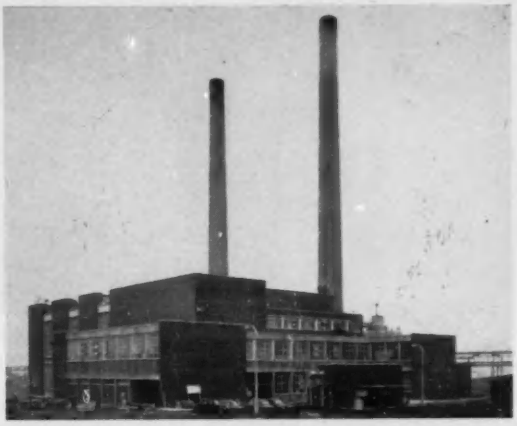
All the main electrical equipment for the mill was supplied and installed by the English Electric Co., Ltd. The cabling, which totalled about 75 miles in length, was supplied by British Insulated Callender's Cables, Ltd., while all the ending and making-off was carried out by F. H. Wheeler (Sheffield), Ltd. The lighting installation was by Lilleker Bros., Ltd.

Control pulpit for the down-coilers

A new back-pressure generating plant has been built by Lever Brothers at Bromborough to replace several ageing boiler plants and to provide process steam for ten factories in the area as well as the generation of electricity. The Merseyside power station, as it is known, comprises four 100 klb/hr oil-fired boilers and four back-pressure turbo-alternators with a total capacity of 14 MW

UNILEVER BACK-PRESSURE PLANT

INAUGURATED BY LORD LEVERHULME



The new Merseyside power station of Unilever, Ltd., at Bromborough

MERSEYSIDE POWER STATION

THE Unilever factories at Port Sunlight and Bromborough are large users of steam and during recent years it became evident that their separate and ageing boiler plants should be replaced by a centrally situated plant which would incorporate back-pressure turbines for the generation of electricity. A pilot scheme involving the installation of two 55 klb/hr boilers at the company's central power station and a 1·3 MW back-pressure turbo-generator set in an adjoining building was completed in 1953.

In the meantime Ward & Partners, in association with the engineering staff of Lever Brothers, Port Sunlight, Ltd., prepared a preliminary design for a central coal-fired power station and a more extensive steam distribution network. It was subsequently decided to use oil fuel and in 1954 design work was begun on the plant now known as the Merseyside power station comprising four 100 klb/hr boilers and four back-pressure turbo-generator sets with a combined capacity of 14 MW.

Water supply and treatment plants and ancillary services with the associated steam distribution network were included in the design and construction work on the site commenced in September, 1956. The first section of the plant was commissioned in April last and earlier this week the completed station was officially opened by Lord Leverhulme.

Old Plant Superseded

The new plant is connected with the existing pilot scheme, and as parallel operation with the Merseyside and North Wales Electricity Board had already been established at the central power station, energy requirements which cannot be provided from the new plant will continue to be met by the Board. As a result of the scheme three boiler plants at Port Sunlight and plants at Price's (Bromborough), Ltd., British Extracting Co., Ltd., Bromborough Dock, Brotherton & Co., Ltd., Fawcett Preston & Co., Ltd., Brookhirst Switchgear, Ltd., and Lloyd & Cross, Ltd., will be closed, in addition to those at the " Stork " margarine works and hydrogenation plant which ceased to operate when the pilot scheme was introduced. Of these plants one at Port Sunlight and one at the British Extracting Co., Ltd., will be retained as standby.

The main building covers an area approximately 250ft by 140ft and is of steel-framed construction. All main stanchion foundations rest on solid rock. Integrated with the boiler and turbine rooms is the ancillary block, consisting of workshop, canteens, cloakrooms, and the water treatment plant. The control room, switchrooms and administrative section are housed in a steel-framed building, physically separated from the main building to minimise noise and vibration.

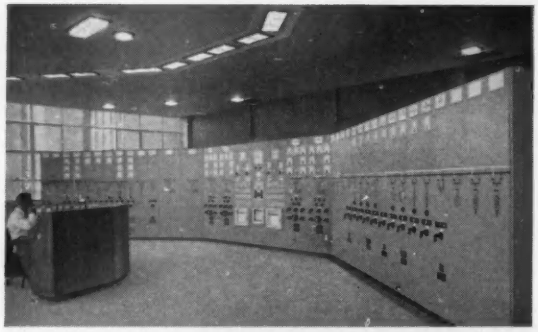
Operating Conditions

The boiler house contains four Babcock & Wilcox integral furnace, oil-fired boilers, each having a maximum continuous rating of 100 klb/hr, operating at 650 p.s.i., 850 deg F, and having a full load oil consumption of 8,150 lb/hr. Each is equipped with one steam and one water drum, water walled furnace, pendant loop type superheater, and tubular type attemperator, capable of maintaining the superheater outlet temperature at 850 ± 15 deg F above 70 per cent maximum continuous rating.

Fuel oil, having a maximum viscosity of 3,500 seconds, gross calorific value 18,300 B.Th.U. per lb, and 4 per cent sulphur content, is supplied to the four boilers via two pumping and heating units, each rated at 20 klb/hr and each containing one electric and one steam driven oil pump and duplicate steam heaters. Oil is delivered to the two 5,500 ton station storage tanks via a pipeline from the Shell pumping station at Ellesmere Port.

The firing equipment on each boiler consists of four register type steam-atomising " Y " jet burners. The boilers are fitted with non-retractable mass and multi-jet element type sootblowers and a rack type sootblower within the superheater region.

The guaranteed m.c.r. thermal efficiency of the boilers on gross calorific value is 84 per cent under clean conditions, subject to tolerances of 2 per cent. The forced and induced draught fans, thermal links (for fire protection), atomising steam and oil pressures, master oil valve and individual burner oil valves on each boiler are sequence interlocked to ensure safe operation. The



Part of the main station control room

induced and forced draught fans are driven by Laurence, Scott variable-speed a.c. motors.

The Bailey automatic boiler control system is designed to maintain efficient combustion by control of fuel oil flow, forced draught, induced draught, steam temperature and steam pressure. The equipment, which is housed in a central boiler control room, carries out the simultaneous operations of automatic steam pressure, temperature and combustion control. Draught control is by dampers for loads up to 50 per cent of maximum continuous boiler rating and thereafter by motor speed regulation. Steam purity is continuously monitored by Dionic equipment and is normally 2 p.p.m. expressed as NaCl.

Back-Pressure Turbines

The turbine bay contains two B.T.H. 4,520 kW back-pressure primary turbines and two B.T.H. 2,500 kW extraction back-pressure secondary turbines. The primary turbines, with eight impulse stages, pass 200 klb/hr at full load with inlet conditions of 625 p.s.i. and 825 deg F, and exhaust conditions of 230 p.s.i. and 639 deg F. The direct-coupled alternators run at 3,000 r.p.m. and generate at 11 kV and 0·8 power factor. Each set is fitted with a direct-driven single-unit exciter.

The secondary turbines run at 6,000 r.p.m. and have six impulse stages, and pass 152·5 klb/hr at full load with inlet conditions of 220 p.s.i., 630 deg F. Extraction and exhaust conditions are 110 p.s.i., 532 deg F, and 20 p.s.i., 335 deg F, respectively. The maximum extraction flow is 120 klb/hr. The salient-pole alternators are driven by double-helical reduction gears at 1,500 r.p.m. and generate at 3·3 kV and 0·8 power factor. Each set is fitted with a direct-coupled exciter and overhung pilot exciter. All alternators are equipped with B.T.H. electronic voltage regulators, and have closed-circuit air cooling with fans on the alternator shafts.

Attemperator control of the boiler steam temperature enables a constant steam temperature to be maintained from under 20 per cent of the station load to full load. The turbine exhaust temperatures are therefore raised as load is reduced, and compensate for the increased temperature drop in the transmission mains at reduced load.

A steam pressure reducing and desuperheating plant is installed. Normally, steam will not pass through these units, but if a turbine shuts down for any reason the appropriate equipment will come into operation automatically and maintain process steam supplies.

Ten factories within a radius of 1½ miles are supplied with steam. A maximum flow of 340 klb/hr of steam for process can be exported at pressures of 230 p.s.i., 630 deg F, and 110 p.s.i., 510 deg F. To feed the boilers a six-mile pipeline has been laid to bring River Dee water from the West Cheshire Water Board's plant at Great Sutton, and emergency supplies are available from Port Sunlight wells. From the 1,000,000 gal capacity station reservoir water passes through a 45,000 gal/hr treatment plant supplied by John Thompson-Kennicott, Ltd. Two electric and two steam-driven feed pumps supply feed water to the four boiler units. Each pump is designed to deliver 240 klb/hr of water at 185 deg F and 850 p.s.i. The 3·3 kV electric motors are rated at 365 h.p. and are arranged for direct-on-line starting.

The Merseyside power station is connected to the existing electrical system by two 0·3 sq in cables terminating at the 11 kV switchboard in Port Sunlight south substation, and two 0·4 sq in cables terminating at 7·5 MVA, 11 kV/6·6 kV system interconnecting transformers at the central power station.

The station 11 kV and 3·3 kV systems are interconnected by two 5 MVA star/star transformers with delta-tertiary windings, off-load tap-changing equipment, liquid neutral-earthing resistors and protection by Buchholz, "Translay," overcurrent, and standby earth-fault relays. Station 415 V supplies are obtained from four 750 kVA delta/star 3·3 kV/415 V transformers fitted with Buchholz, overcurrent, and restricted earth-fault protection.

The 11 kV switchgear serves the four interconnecting cables, two primary alternators, two station transformers, a bus-section switch and a bus-coupler. The switchgear is Reyrolle type B3T compound-insulated, duplicate busbar, metalclad gear with horizontal draw-out oil circuit-breakers rated at 350 MVA, and is fitted with bus-zone protection. The 3·3 kV switchgear controls the two station transformers, two secondary alternators, four unit transformers, two feed pump motors, a bus-section switch and bus-coupler. The switchgear is English Electric air-break duplicate busbar class "E" type OB33L rated at 150 MVA and is also fitted with bus-zone protection. Each of the 415 V substations is equipped with English Electric type OB2 air-break switchgear with bus-section switches; the 415 V supplies are fed to the station via ten fuse-switch boards.

Operation of all high-voltage breakers is remotely controlled from a 35-panel corridor type control board in the control room immediately above the two h.v. switchrooms. A 350 Ah lead acid battery is provided for circuit-breaker operation and emergency lighting. The electrical and steam systems are controlled from the main control room. The control board, which is of open U-shape, houses the 11 kV and 3·3 kV circuits and an alarm annunciator panel, with steam system instruments and controls. A control desk in front of the board incorporates meters showing the import from MANWEB, the turbine back-pressure and extraction-pressure regulators, the 110 and 230 p.s.i. reducing valve pressure regulators together with remote indication of pressure, temperature and flow at strategic points on the steam system.

I.E.E. Christmas Lecture

THE Christmas holiday lecture for school children arranged by the Institution of Electrical Engineers will be given at the Institution, Savoy Place, W.C.2, on Wednesday, 31st December (3 p.m.), and again at the same time on the following day. The subject will be "Invention and New Machines," and the lecturer will be Dr. E. R. Laithwaite of the Electrical Engineering Laboratories, Manchester University. Dr. Laithwaite will also give this lecture in the North-Western Centre of the I.E.E. on 29th December at the Royal Technical College, Salford, on 3rd January at the Technical College, Bolton, and on 10th January at the Manchester College of Science and Technology.

VITREOUS ENAMELLED RESISTORS

PRODUCTION AT A STAFFORDSHIRE FACTORY

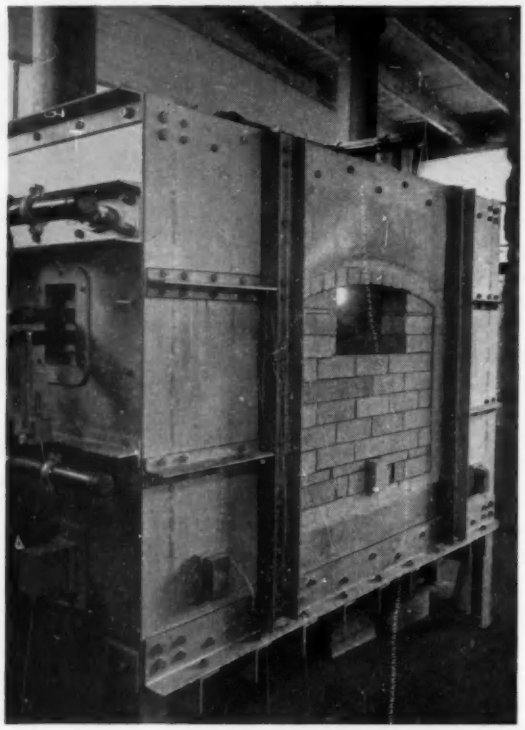
A new plant for the production of vitreous enamelled resistors has recently been put into operation by H. A. Birch & Co., Ltd., at Willenhall, Staffs. These components have been type approved for Services use and conform to the relevant R.S.C.S. specifications. This article describes the techniques employed in manufacturing these resistors so that they have a high degree of accuracy and stability

It is now almost twenty-six years since H. A. Birch & Co., Ltd., Willenhall, Staffs., was founded and during that time the company has built up a high reputation for the manufacture of a wide variety of regulators, variable and fixed resistors, heating elements and kindred products. It had long been the company's intention to include vitreous enamelled resistors in this range and three years ago it was decided to put this intention into effect. For that purpose freehold premises were secured in Cannock, Staffs., which were conveniently situated with respect to supplies of raw materials both from the Potteries and the Midlands and also with adequate public services, particularly of gas and electrical power.

Good progress has been made and the new plant is now in production. The work involved consisted of almost the entire reconstruction of the existing premises to ensure the very high standards of cleanliness necessary, and the installation of a large gas-fired smelting furnace for the production of the enamel, together with a battery of five 40 kW electric resistance furnaces, with their fully-automatic control gear for off-peak loading, and all the smaller equipment such as winding machines and welders. The vitreous enamelled resistor is, on the face of it, a simple looking device, familiar to all electrical engineers, but it is only when this device has to be manufactured to the very high degree of accuracy and stability needed to conform to the requirements and the specifications of the Radio Components Standardisation Committee (R.C.S.C.) that the problems involved become manifest. Incidentally, all the vitreous enamelled resistors made by the company are type approved for Services use and conform to the R.C.S.C. specifications R.C.S. III, Issue 3 and R.C.L. III, Issue 2.

The origin of the vitreous enamelled resistor dates back to somewhere before the first world war. The primary object of producing these resistors was to provide compact units of high ohmic value and high dissipating capacity for their size. The two requirements of small size and high ohmic value necessitate the use of fine wires of high specific resistance. In order to prevent mechanical damage to such a unit by inadvertent contact with other components or tools, and to prevent the slackening and touching of adjacent turns due to the heating of the winding when in service, a protective and adherent

General view of the main assembly shop



Gas-fired smelting furnace for the enamel

Resistance wire is wound on to the ceramic formers using automatic machines

covering is called for. To ensure the further requirements of high dissipating capacity for a given size and consequent high temperature rise, some such inorganic and heat-resisting material as vitreous enamel is the obvious choice.

The vitreous enamelled resistor consists primarily of three components: viz. a base tube, a wire winding, and an enamel coating. It is well known that ceramics have, in general, a very much lower coefficient of thermal expansion than the majority of alloys which can be used for the winding. For the latter, materials of high specific resistance, high melting point, resistance to corrosion and low temperature coefficient, are obviously needed. Very few materials other than the binary 80/20 nickel/chrome of high purity offer such advantages and this material therefore becomes the obvious choice: in fact it is used exclusively in this new range of resistors.

It is clearly the duty of the base tube and vitreous enamel coating to give full mechanical support and chemical protection to the winding. As there is every possibility of a considerable proportion of the wire winding of the finished article being in contact with the base tube, this must be completely non-porous. To ensure this, all Birch units are wound on fully vitrified high-tensile porcelain. It is essential that the coefficients of expansion of the enamel coating and of the tube shall be accurately matched to a tolerance of better than one part in two millions per deg C. Furthermore, it is highly desirable that the expansion of the enamel shall always be a little less than that of the tube. Only in this way can a unit be manufactured which will be positively free from the slightest degree of crazing over the temperature range -40 deg C to $+450$ deg C, which is necessary to meet the current Services specifications.

Having established a bulk supply of high-grade tubes of great uniformity in characteristics it is necessary to produce a matching enamel, and for this purpose the company has installed its own complete enamel smelting plant. The material is, in fact, an opaque glass of high complexity, containing many raw ingredients, which in a full melt vary in quantity from several hundredweights to a few ounces, all of which are important and accurately controlled. To ensure that the performance of the finished enamel will be as required, all bulk supplies of raw materials are subjected to rigorous tests for composition and moisture content. For this purpose a comprehensive chemical and physical laboratory has been installed in the works.

In melting, the glass or enamel is matured in a controlled atmosphere in the specially constructed smelting furnace for many hours at high temperature, in order to ensure that all chemical reaction is completed and that all evolved gases are allowed to escape. The resultant mass of glass is subsequently broken up in an electrically-driven multi-hammer mill and afterwards ground with water and other additives to form a final enamel slip which is applied to the wound tubes.

It has been proved by both privately conducted and official Government tests that the failure of badly constructed vitreous enamelled resistors has been very largely due in the past to a combination of crazing, porosity of the base tube, and impurities in the alloy of the winding. Obviously, the manufacturers of nickel/chrome wires endeavour by skill and care to avoid all such impurities so that the high-grade wires supplied to the company are beyond suspicion. This being so, it behoves the resistor manufacturer to avoid contamination at his end. For this reason, all Birch units are manufactured throughout from the same uniform high grade of nickel/chrome, and all joints are made using electronically-controlled

welders without the intervention of any other material whatsoever. If any other method of jointing were employed, e.g. silver soldering, which to be effective would have to alloy with the nickel/chrome, this would introduce an impurity. Similarly, in all stages of making and grinding the enamel every means has to be taken to avoid any trace of metallic dust, particularly that containing zinc or copper.

A good example of the care taken in manufacture is provided by a description of the various steps involved in the construction of some of the smallest of the company's products, viz. the miniature wire-ended resistors so widely used in electronic products and smaller equipment ranging from domestic appliance suppressors, radio and television receivers to radar equipment and electronic computers.

Starting with the refractory tubes, these are given a thorough visual and mechanical inspection on arrival at the works after which they are washed and dried prior to being issued to the winding department. The end leads are then tightly bound around the tubes, having previously had an intermediate joint wire or tape electrically welded to them. These leads are then twisted together and spiralled so as to be conveniently out of the way during winding and subsequent firing. The tube fitted with its end leads is next provided with the appropriate winding on precision machines, a number of which have been specially constructed to the company's own design. After winding, the resistance value is checked; otherwise after enamelling the unit might be a worthless reject. The joint between the intermediate wire or tape and the winding is then made by using electronically-controlled spot welding machines. At this stage the unit is passed to the enamelling department where it is coated by a wet process, dried, any surplus removed, and fired in one of the five 40 kW electric furnaces which were also designed by the company's own engineers and constructed in the works.

Enamelling Process

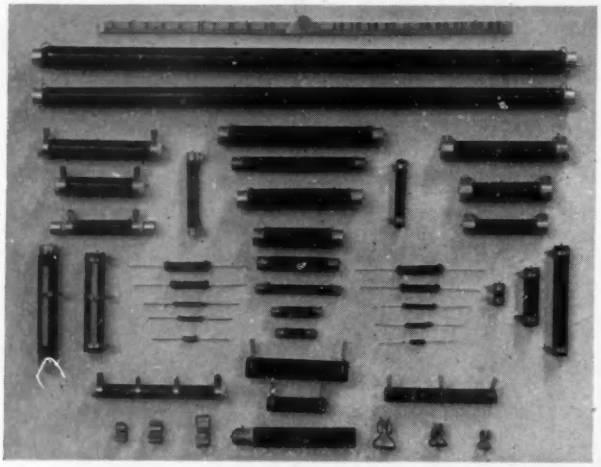
One of the essential features of the enamelling process is that the temperature rise shall not be so rapid as to crack even the largest tube and that the cooling shall be slow and uniform so that the finished product is fully annealed. In general, two coats of enamel are applied as by this method the inclusion of even the smallest bubble or pinhole is avoided as this might easily be many times the size of the finest wire employed. After enamelling, the units are given a thorough visual test and the resistance is measured by means of a Wheatstone bridge.

Any units which fail at this stage are uncompromisingly destroyed. All satisfactory units are then machine printed by the offset process with the maker's name, resistance value and rating, etc., using an ink comprising a vitreous enamel ground in a suitable medium. The printed units are then returned to the furnace department where the printing is fired in at high temperature, which is well above any normal working temperature but considerably below the melting point of the base enamel. In this way the units are provided with a permanent and completely indelible marking. After this, all units are again subjected to a visual inspection and further resistance test before being passed to have their wire terminations fitted. These wires, which are of standard tinned copper, are accurately bent to shape and dimensions, and inserted into the ends of the tubes, being secured by a special silicone cement capable of withstanding working temperatures in excess of 450 deg C. This cement is stoved to secure its properties.

In the semi-finished state all resistors are tested on a bridge for ohmic value

Wound units being coated with enamel

Identification markings are printed on to the units and subsequently indelibly fired into the enamel



This display indicates the comprehensive range of resistors made

The twisted leads and the tinned copper wires are then brought together and the surplus cut off. The joint between the two is then made by silver soldering employing an electrical process. To ensure the instantaneous tinning of the copper lead when the unit is finally soldered into position for service, the leads are then dip-tinned.

The unit is then complete, but before going to the dispatch department it is washed and brushed in boiling water, baked dry and then washed in acetone to remove all traces of the flux used either in the silver soldering or tinning operations. After a complete check of individual physical dimensions, resistance value and tolerances, the unit is deemed fit for dispatch to the customer.

The manufacture of larger units is very similar at all stages, except that such articles are fitted with a wide variety of different terminations such as ferrules, bands, flexible leads and so on. Realising that many of the larger users of these units might wish to purchase their entire supply from one manufacturer for the sake of convenience and that many other users would have their own individual requirements and preferences regarding design and construction, the company decided from the outset to manufacture all and every size and type of vitreous enamelled resistor at present catalogued in this country. In addition, it has also made some of what are believed to be the largest vitreous enamelled resistors ever produced, being nearly 3ft long and 1¼in in diameter. A full range of pre-set types having either full length or shorter exposed tracks, and with one or more adjustable tapping bands, are also made. The company also makes all but the very smallest sizes of units with intermediate tappings and Ayrton-Perry low-inductance windings.

GAS-FILLED CABLES

As a result of service experience over the past twenty years many detail modifications have been made in the gas-filled cable, which was first described by Messrs. C. J. Beaver and E. L. Davey before the Institution of Electrical Engineers in 1943. These changes with some notes on possible future developments in land service cables formed the subject of an Institution Supply Section paper on 17th December by Messrs. E. P. G. Thornton and D. H. Booth (W. T. Glover & Co.).

The constructional features of the 680,000 yd of cables at present in use for single-core 132 kV and three-core 33 kV systems are shown in the diagram on page 1197. These cables are not usually armoured, since the site testing of the anti-corrosion covering and the supervisory nature of the internal gas pressure prevents both immediate and subsequent damage. Their main characteristics are given in the appendix. The first commercial installation at 275 kV in Britain is due to be made at the end of this year.

After describing in detail the special pre-impregnation machinery and the experimental studies, using cable model techniques, of dielectric, quality of impregnation, materials and constructional variables, the authors dealt with the design of accessories, the testing of cables and miniature systems and present-day installation methods.

The non-draining nature of the dielectric of the gas-filled cable was obtained by the control of surface compound by a scraping process and not by using a high melting-point impregnant. Pre-impregnation facilitated manufacture of long cable lengths owing to the elimination of the factor of the physical capacity of the tanks. The moisture content of the paper roll should be less than 0·2 per cent to give optimum values of impulse strength, power factor and mechanical characteristics, though for completed cables an average of 0·38 per cent with a standard deviation of 0·13 had proved satisfactory. Paper thickness did not materially affect impulse performance, but on a.c. circuits there was a 21 per cent increase in ionisation stress with 1¼-mil papers over 4-mil papers, so a dielectric graded by thickness had been incorporated. Increasing gas pressure from 200 lb to 250 lb/sq in would provide only a small improvement in impulse strength but would give 18 per cent improvement in ionisation stress with 1¼-mil paper.

In jointing, hand-applied taping was similar to that used for the fully screened solid type. Time occupied was 25 hours for single-core 132 kV joints and 28 and 24 hours respectively for three-core 66 and 33 kV joints. For locating gas leaks (which almost all occurred at accessories) two methods were used in conjunction: measurement of fall in pressure along the route, using gauges at the gas-charging points, and injection at the nearest gas-charging point of a halogen and electronic detector. Only two electrical failures of cables had occurred, one of which was due to mechanical damage.

Prefabricated or extruded pressure-retaining accessory components had generally superseded castings so as to avoid leaks due to porosity. All accessories were now tested at 300 lb/sq in under water after a hydraulic test of 600 lb/sq in. Recent cables, both armoured and unarmoured, had a fully compensated reinforcement protected by anti-corrosion serving. A leak on a 66 kV single-core cable due to localised stress corrosion of its tin-bronze reinforcing tapes resulting from attack by ammoniacal vapours, probably emanating from a sewer, indicated (contrary to the general view) that no copper

alloy was immune from this trouble but that complete and lasting protection followed the application of anti-corrosion serving.

The first gas-filled 132 kV cable (5,280 yd, 0·3 sq in) was laid at Wimbledon in 1937, but by 1950 the conductor size was no longer adequate for the capacity of an overhead line in series. Examination at the factory showed no visible evidence of deterioration, which was substantiated by measurements of radial power factor and moisture and compound content and by power factor-voltage and impulse tests on samples from the dielectric.

Regarding future development, while compacted or segmental conductors were desirable for the most economic use of materials, they necessitated a possibly difficult compromise between dimensions, flexibility and conductivity. Screening might be omitted on lower-voltage cables and carbon-paper screening used for higher voltages. Decrease in overall dimensions due to higher operating stresses was likely to lead to the production of three-core 132 kV cables. Increase of gas pressure (as used for submarine cables at 300 lb/sq in) might be introduced, perhaps in association with a pipe system. A promising combination was pre-impregnated paper interleaved with polystyrene, which would increase impulse strength. Avoidance of reinforcement and sheath losses by the substitution of polyester-resin with glass-fibre laminates for metal components was being investigated.

Appendix.—Typical characteristics of gas-filled cables

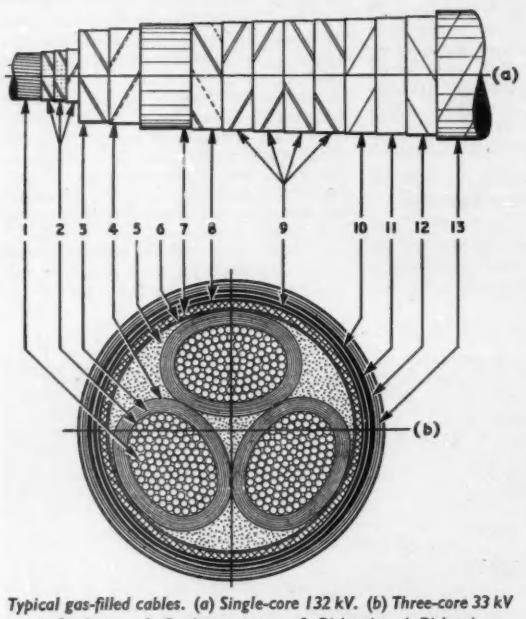
Conductor.—Copper or aluminium; for single-core cable for all voltages the section is "died down" circular; for 33 kV 3-core it is oval, and for 66 kV 3-core it is circular up to 0·5 in² and oval at 0·55 in² and above, the change point being decided on economic grounds.

Conductor screen.—Two or three layers of metallised paper according to operating stress.

Paper.—1¾, 2¼, 4 and 6-mil wood pulp, pre-impregnated to give non-draining dielectric over the complete operating temperature range. Special high-density papers are used for cables in which the conductor stresses are 100 and 110 kV/cm.

Impregnant.—Refined paraffinic jelly.

Core screening.—Copper tape or metallised paper applied with an overlap.



Typical gas-filled cables. (a) Single-core 132 kV. (b) Three-core 33 kV

1. Conductor. 2. Conductor screen. 3. Dielectric. 4. Dielectric screen. 5. Jute fillers. 6. C.W.F.T. binder. 7. Lead sheath. 8. Copper-wire-woven fabric tape. 9. Reinforcing tapes. 10. Bituminised cotton tape. 11. Rubber sheath. 12. Carbon-impregnated tape. 13. Hessian tapes

Lead-alloy sheath.—0·1 per cent antimonial alloy is a standard, but alloys E or B are used for conditions of moderate and severe vibration, respectively.

Reinforcement.—For single-core cable it is 1 per cent tin-bronze; for three-core cable it is mild steel, with 1 per cent tin-bronze for improved current ratings. All tapes are applied in four layers at the critical angle such that provision is made for longitudinal and circumferential components of the pressure load. The outer and inner two layers are applied in reverse directions. All tapes are applied with a small gap on a single-, double- or treble-start principle to limit individual tape widths to 2in in order to maintain a satisfactory bending performance.

Anti-corrosion serving.—An impermeable layer comprises four layers of unvulcanised tough-rubber tapes applied between a bituminised-cotton tape and a carbon-impregnated cotton tape. The rubber tapes are vulcanised and bonded by heat. The carbon-impregnated tape serves as an outer electrode for the electrical testing of the rubber sheath.

Conductor stress	75 kV/cm at 33 kV 85 kV/cm at 66 kV 90 or 100 kV/cm at 132 kV 110 kV/cm at 275 kV
Dielectric thermal resistivity ..	550 thermal ohm-cm
Maximum operating temperature ..	85 deg C
Permittivity	2·9
Power factor at working voltage ..	0·0040 at 20 deg C 0·0030 at 50 deg C 0·0035 at 90 deg C
Nominal gas pressure	200 lb/in²
Minimum operating gas pressure ..	180 lb/in²
Maximum design gas pressure ..	250 lb/in²

Electric Locomotive Maintenance

IN a paper presented before the Institution of Locomotive Engineers on 10th December, Messrs. J. S. Scott and J. K. Lord (British Railways) recorded their experience in maintaining the fifty-eight 1,868 h.p. six-wheel Bo+Bo and the seven 2,760 h.p. twelve-wheel Co-Co two-bogie electric locomotives which operate on the Manchester-Sheffield-Wath main line traversing the Pennines. Average gradients are 1 in 147 for 22 miles and 1 in 127 for 19 miles, while 1 in 40 is reached for almost 2½ miles.

The Bo+Bo locomotives, which weigh 86 tons 14 cwt and have a maximum speed of 65 m.p.h., have now run 11½ million miles hauling mixed traffic. They are equipped with nose-suspended axle-hung traction motors. The 103 ton Co-Co locomotives, which have three unconnected axles per bogie, use axle-suspended motors. There are also eight two-bogie (with two axles each) three-vehicle multiple-unit trains running on the Manchester-Glossop-Hadfield service which are driven by axle-hung nose-suspended 210 h.p. motors permanently connected in pairs.

The maintenance or examination schedule at the two repair depots is based on periodicity, which for the locomotives is seven days and for the multiple-unit stock eight running days in two weeks. No serious defect, the authors stated, has been found on any traction-motor armature, but several commutators have been re-turned by a diamond tool.

Experience indicates that traction motors and other electrical equipment of locomotives should be generally overhauled every five years and that of the multiple units every four years. Suggestions for increasing availability include: provision of improved brush holders and springs; roller bearings instead of whitemetal-lined bronze bearings for axle-suspended motors; better pantograph lubrication to reduce wear; and the possible fitting of lightning arrestors. Many of these recommendations have been adopted in more recently designed locomotives. The general aim of the procedure is quick change of components and replacement of worn parts accompanied by immediate availability of spares fully overhauled and tested. The result so far has been 93 per cent availability for the whole stock.

INDUSTRIAL NEWS

Scottish Scholarship Scheme

In collaboration with the Faculty of Applied Science at the University of St. Andrews, Queen's College, Dundee, the British Thomson-Houston Co., Ltd., Rugby, has introduced a new scholarship scheme designed to help suitable school leavers to become professional electrical engineers. The scheme is for boys who are normally resident in the counties of Angus, Perthshire, Fife, Kinross and Clackmannan, and covers both the academic and practical training essential for commercial and design engineering. Boys who are interested in the plan can obtain details from their headmasters.

G. & J. Weir Changes

The name of G. & J. Weir, Ltd., will be changed to G. & J. Weir Holdings, Ltd., on 31st December. On the same date the Cathcart trading undertaking will be transferred to a new subsidiary company with the name of G. & J. Weir, Ltd., given up by the parent company. The parent company will thereafter operate as a holding company under the direction of the present board, as follows:—Hon. J. Kenneth Weir (chairman), Mr. J. W. W. Drysdale (deputy chairman), and Mr. J. Russell Lang, Mr. N. M. Niven, Sir Charles Connell and Mr. J. A. Lumsden (directors). Mr. J. Davidson, F.C.I.S., secretary of the company, is retiring and will be succeeded by Mr. J. J. B. Young. The board of the new operating subsidiary company will be as follows:—Hon. J. Kenneth Weir (chairman), Mr. J. Russell Lang (managing director), Mr. J. W. Atwell (deputy managing director), Mr. A. C. Smith (sales), Mr. J. J. B. Young (finance), Mr. Gavin Milligan (works) and Dr. R. S. Silver (technical). The secretary of the new company will be Mr. H. Waugh.

Simmonds Aerocessories' German Subsidiary

Simmonds Aerocessories, Ltd., a member of the Firth Cleveland Group, announce the formation in Germany of Deutsche Firth Cleveland G.m.b.H. as a subsidiary company. The new company, which has taken over offices at Neckarauerstrasse 245-53, Mannheim, has been set up in anticipation of the establishment of the Common Market and the Free Trade Area, and it will undertake the marketing in Germany of most of the products of Simmonds Aerocessories, Ltd., as well as those made by Simmonds' British subsidiary, Firth Cleveland Instruments, Ltd. Mr. A. A. Puth has been appointed general manager of Deutsche Firth Cleveland G.m.b.H. He is assisted by Mr. H. Seiler as Surform sales manager. All the products handled by the new company will continue to be made at Treforest, Glamorganshire.

G.E.C. Vacuum Furnace Agreement

The General Electric Co., Ltd., announces that an agreement has been reached with Vacuum Industrial Applications, Ltd., of Wishaw, Scotland, which combines the resources of the two companies in the vacuum heating field for the development of vacuum heating techniques and the design and manufacture of complete vacuum furnace installations. Acting jointly, the companies command excellent facilities for research, design and manufacture and are well equipped to meet demands for complete installations for vacuum melting, sintering, brazing, degassing, stream degassing and general heat treatments. Under the terms of the agreement inquiries will be handled by the General Electric Co., Ltd.

A.S.E.E. Employment Bureau

The A.S.E.E. Employment Bureau, which is approved and licensed annually by the London County Council, provides, without charge, a confidential service to both members and employers. The Association will be pleased to receive details of vacancies from employers in the electrical and kindred industries who wish to appoint or replace supervising engineers, executives and technicians. Further information may be obtained from the General Secretary, Association of Supervising Electrical Engineers, 23, Bloomsbury Square, London, W.C.1 (telephone: Langham 5927-8-9).

Dorman Smith's New Factory

Dorman Smith, Ltd., who were first established in Salford nearly eighty years ago, have converted a disused cotton mill in Blackpool Road, Preston, into a modern factory for the manufacture of electrical products. Known as the Atherton Works (after Mr. T. Atherton, chairman and managing director of Dorman & Smith, Ltd., the parent company), the factory is now the head office and works of the company and is producing switchgear, miniature circuit-breakers, lighting fittings, fusegear and cable accessories. The new factory is providing work in an area where there was much unemployment, as only key men from the old works in Salford have been transferred, the rest of the labour force being recruited locally.

Sewage Works Diesel Plant

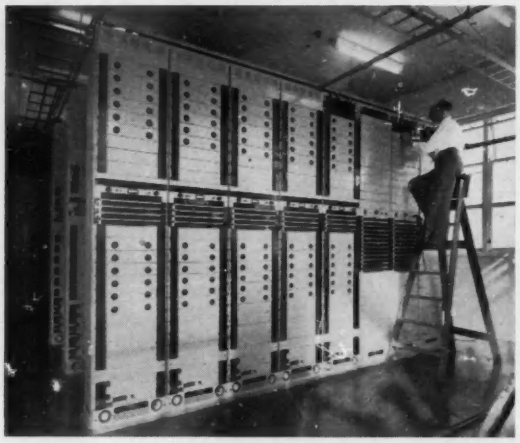
The Middlesex County Council has placed an order for sixteen dual-fuel engines, complete with all accessories, with the English Electric Co., Ltd. They are for the Deephams sewage purification works at Edmonton and total over 10,000 h.p. The order is for fifteen 5-cylinder RLD engines and one 8-cylinder RKD engine. The RLD type will be manufactured at the Rugby works and the RKD engine at Preston. Other works involved in the contract are Bradford, Stafford and Liverpool. The contract will be engineered and controlled from the company's Diesel Engine Division at Brownsover Hall, nr. Rugby.

Colliery Electric Winding Engines

The General Electric Co., Ltd., has received an order valued at approximately £100,000 for a winding engine for Cortonwood Colliery (No. 1 Shaft) in the North Eastern Division of the National Coal Board. This order comprises a double-drum single-clutch winder, with drums 16ft in diameter by 6ft 6in wide, driven through reduction gears by a 3·3 kV a.c. motor of 2,000 h.p. at a maximum speed of 356 r.p.m.

When completed the equipment will raise coal from a depth of 1,740ft and have a lifting capacity of 336 tons an

One of the main assembly shops at the Atherton Works, Preston, of Dorman Smith, Ltd.



Completing the wiring at the Hamilton (N.Z.) terminal station

hour. It will also serve to lift men to the surface from three levels. The winding engine will incorporate the latest type of G.E.C. dynamic braking, and will have mechanical brakes of the company's air/oil rapid pressure-operated type. This order is the third in recent months placed by the National Coal Board with the G.E.C. for 16ft diameter double-drum winders.

Whitaker's Almanack

The 1959 edition of Whitaker's Almanack, in addition to including information which has for many years made the Almanack an indispensable work of reference, contains details of the various earth satellites launched during the year; of the voyage of the *Nautilus*; and of Sir Vivian Fuchs' crossing of the Antarctic, and their scientific implications and value are discussed. Other matters dealt with are British coal production and higher technical education. The Almanack is published in three editions: complete edition (over 1,190 pages), cloth boards (18s 6d); shorter edition, paper bound (10s); and library edition, bound in leather, with coloured maps (35s). It is published by J. Whitaker & Sons, Ltd., 13, Bedford Square, London, W.C.1.

New Zealand Trunk Telephone Network

A landmark in New Zealand communications has been reached with the bringing into service of the coaxial cable carrier telephone system between Auckland and Hamilton. The system, which is capable of carrying 960 telephone circuits, was supplied by the Automatic Telephone & Electric Co., Ltd. Installation was carried out by the staff of the N.Z. Post Office under the supervision of A.T. & E. personnel. Fourteen unattended repeater stations are used along the 80-mile route. The initial provision of 240 circuits will give an improved trunk telephone service between the towns and will allow the existing overhead wires to be taken out of use. This marks the completion of the first link in the new chain of telephone connections between Auckland and Wellington under the policy of the New Zealand Post Office for the improvement of the trunk network. The A.T. & E. is supplying similar equipment for use on a microwave radio link which is being set up between Hamilton and Palmerston North, and on a coaxial cable which is being laid between Palmerston North and Wellington.

P.O.A. Courses

A non-residential course on "The Industrial Purchasing Officer's Role in Constructional and Engineering Contracts," arranged by the Purchasing Officers' Association, will be held from 17th to 19th February at Stationers' Hall, Stationers' Hall Court, Ludgate Hill, London, E.C.4. The fee for the course is 10½ guineas. The Association has also arranged a residential course for chief buyers, "The Second Advanced Purchasing Course," to be held from 13th to 18th April at Christ Church, Oxford. The inclusive fee is £25.

Particulars of these courses can be obtained from the Secretary, Purchasing Officers' Association, Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4.

Process Instrumentation Symposium

A one-day symposium covering instrumentation in various process industries, held recently by Sunvic Controls, Ltd., was attended by more than fifty directors and executives from chemical and petroleum companies and electricity authorities in addition to other companies in the A.E.I. group. The chairman of the symposium was Mr. N. R. Davis, managing director of Sunvic Controls. The five papers delivered covered the techniques and applications of automatic control and instrumentation applied to processes involving continuous flow production, with particular reference to oil, chemicals and nuclear power, and in addition surveyed future development and trends. Emphasis was placed on data processing and automatic computation in relation to fully automatic plant control applications, and the commercial implications of instrumentation were also considered. Visitors were able to inspect the manufacture of current Sunvic products and attend the demonstration of a complete data handling unit.

Long-Service Moving-Iron Instrument

The moving-iron instrument shown in the accompanying picture was "discovered" by Tyer & Co., Ltd., railway signalling engineers, of Dalston, when they recently moved from their old premises. Some research into its history revealed that it was made in 1883 by R. E. Crompton & Co.—now Crompton Parkinson, Ltd. The instrument is in remarkably good condition and an interesting feature is that the hand-engraved scales are denoted "current" and "potential" but the terminal posts are marked "amperes" and "volts." Since the International Electrical Congress did not regularise the latter terms until its first meeting in 1881, it appears likely that this was one of the first measuring instruments to use the new nomenclature. No control springs are fitted, the earth's magnetic field being used to provide a restoring torque. As the instrument was intended for horizontal operation

A Crompton long-service moving-iron instrument

it would have to be lined up due north-south before functioning; all 19th century switchboards incorporating instruments with similar movements must therefore have been aligned due east-west!

Kentish Christmas Refrigeration Fairs

The Kent branch of the Prestcold Division of the Pressed Steel Co., Ltd., suggested to the electricity managers in Orpington and Tonbridge that they should hold a Christmas refrigerator fair and it was decided that the two fairs should run simultaneously for one week, starting on 8th December, and before this date window displays and local advertising publicised the events. At each showroom a complete range of the Prestcold domestic models was on display, in

attractive Christmas settings. In addition a number of commercial models were shown, each having its uses indicated to both the retailer and the customer.

Joint English-American Rectifier Company

The International Rectifier Corporation of Los Angeles, California, and Lancashire Dynamo Holdings, Ltd., of England, have announced the establishment of the International Rectifier Co. (Great Britain), Ltd. (the registration is recorded in our "New Companies" section today), which will shortly begin the manufacture of semiconductor products in the United Kingdom. The joint venture was finalised during a recent visit by Mr. A. Newing, a director of Lancashire Dynamo Holdings, to California where he met Mr. E. Lidow, president of International Rectifier and other officers of the company.

A new 10,000 sq ft plant to be built near London is planned for the new company and should be opened before the end of 1959. During the interim period, International Rectifier Co. (Great Britain), Ltd., has set up an assembly line operation for semi-manufactured products which will operate in temporary locations beginning immediately. Principal rectifier products to be produced in England are silicon diodes and silicon power rectifiers.

T.U.C. and the E.T.U.

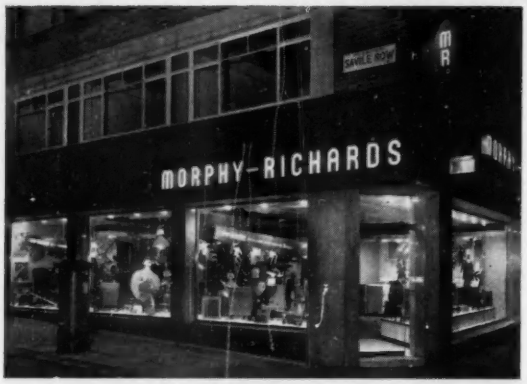
The General Council of the Trades Union Congress last week formally endorsed recommendations on the Electrical Trades Union made by two of its committees. The first was that the E.T.U. should be requested to comment on public criticisms and allegations about the conduct of its affairs and the second called upon the Union not to take part in a proposed international conference of electrical workers which would include representatives of unions affiliated to the World Federation of Trade Unions, a Communist-dominated body, thus infringing the T.U.C.'s rules.

Radio Valve and Cooker Agreements

The Restrictive Trade Practices Court has decided that it will consider the agreement between members of the British Radio Valve Manufacturers' Association on a date not before 7th April, 1959, and the agreement of the Associated Manufacturers of Domestic Electric Cookers not before 22nd June. The Water-Tube Boiler Makers' Association Agreement is to be considered on a date not before 27th April.

Morphy-Richards' New London Showroom

The accompanying picture shows the recently-completed showroom of the new Morphy-Richards, Ltd., London headquarters at 50, Conduit Street, W.1. On the corner of Savile Row, this six-storey building has a floor-space of 16,000 sq ft. The spacious 1,300 sq ft showroom houses an attractively fitted demonstration kitchen and complementary demonstration areas. The overall décor was designed to blend with changing display needs and the new fluorescent "Modulume" system provides maximum illumination. Around the showroom walls there is an interesting series of original Chelsea pottery plaques illustrating laundry scenes in different times and climes. The Servicing Department and stores are situated in the basement. On the five upper floors are the home and export sales offices, the Advertising Department, the Astral sales and general administration offices. The architects for the work on the existing building were Hildebrand & Glicker, with R. Mansell, Ltd., as main contractors for the interior work, and A. Davis & Co. (Shopfitters), Ltd., for the showroom and shop front.



Morphy-Richards' new London showroom on the corner of Conduit Street and Savile Row, W.

Dorman Long Development

An illustrated booklet has been issued by Dorman, Long & Co., Ltd., giving particulars of its post-war development programme and of some of the steel construction work which it has carried out. The illustrations include one of the steel structure of High Marnham power station.

Industrial Safety

The Birmingham and District Industrial Safety Group has issued particulars of its programme of courses during 1959. These include two-day practical training courses in electrical installation, repair and maintenance for works electricians and others which will be held in January, June and November. Particulars can be obtained from Mr. A. Eydes, manager of the Industrial Safety Training Centre, 22, Summer Road, Acock's Green, Birmingham, 27.

Calendars and Diaries

The calendar received from the Westinghouse Electric International Co. has large sheets, with bold figures, each sheet showing three months and illustrating some of the company's products.

A colourful picture of huntsmen "re-living" a fox hunt has been selected by Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd., for their calendar, which has monthly slips.

Some typical scenes of Denmark again illustrate the calendar received from Danfoss, Nordborg.

The calendar of Wandleside Cable Works, Ltd., has monthly slips, mounted on a strong board with a floral picture.

The administrative block and south works of its factory at Tyseley illustrates the calendar of the Midland Electric Manufacturing Co., Ltd., which has monthly slips showing also the preceding and following months.

A useful engagements calendar has been received from Edwards High Vacuum, Ltd.

CIBA (A.R.L.), Ltd., has sent us a desk calendar with monthly slips, each of which has a picture in colour of well-known places in Cambridge.

An attractive picture of a foal adorns the calendar of the Lindley Thompson Transformer & Service Co., Ltd., which has monthly slips, showing also the preceding and following months.

Trade Announcements

Simmonds & Stokes (Niphan), Ltd., has appointed Mr. L. Scull, 94, Danethorpe Vale, Sherwood, Notts. (telephone: Nottingham 26-2198), as its representative in Nottinghamshire, Derbyshire, Lincolnshire, Leicestershire and the West Riding of Yorkshire.

The London district office of **Ferguson Pailin, Ltd.,** has moved to 33, Grosvenor Place, S.W.1 (telephone: Belgravia 7011).

The Beckman/Berkeley universal Eput meter, type 7360, is now available through the United Kingdom selling and servicing agents, **Winston Electronics, Ltd.,** Shepperton, Middlesex. This instrument has a wide variety of uses in universities, industrial research and development laboratories and in industry generally.

Oliver Pell Control, Ltd., has been appointed sole selling agent to Christian Dunker A.G., of Bonndorf/Schwarzwald, Western Germany, for their high efficiency motors, including the GK/26 motor, specifically designed for tape recorders and instruments.

GENERATION and DEVELOPMENT

Kincardine Power Station

Some details of the new power station shortly to be opened by the South of Scotland Electricity Board at Kincardine were given on 11th December by Mr. G. Nicholson, newly-appointed superintendent of the station, when he addressed Dunfermline Rotary Club. He said that the station would be the most efficient in Scotland. Initially, three 120 MW units were being installed and between 1960 and 1963 two 200 MW units would be added, making the total capacity 760 MW. It was hoped to commission the first unit before the end of the year and to start commercial operation early next year.

Future Plans for Scottish Electricity

In connection with the Electricity (Borrowing Powers) Bill referred to in last week's issue, the two Scottish Electricity Boards have together issued a booklet, "Scottish Electricity: Plans for the Future," in which both past achievements and the growth of the load in the next six years are reviewed.

At the end of 1964 the peak demand in Scotland is expected to total 3,250 MW, or 69 per cent more than in 1957. To meet this demand the South of Scotland Board is planning to install plant with an output capacity of 1,173 MW. This will include 300 MW at the nuclear station at Hunterston and 712 MW at Kincardine. There will also be from next year a firm output of 105 MW from the Atomic Energy Authority's station at Chapel Cross. The Board's plans will involve capital expenditure of the order of £165 million. Generation will take £88 million, main transmission £25 million, and distribution £52 million. Because of the exceptional rates of capital development programmed for 1959 and immediately succeeding years, the level of internal financing will temporarily fall, but in later years it is expected to advance well beyond the figure of 40 per cent achieved in the years up to 1957. In the period to the end of 1964, £60 million should be available from internal sources.

In the same period, the North of Scotland Board plans to add 461 MW of plant at a cost of £137 million, and the breakdown will be: Generation £92 million, main transmission £14 million, and distribution £31 million. Provided the Board's Borrowing and Stock Regulations are suitably adjusted, £15 million could be made available from redemption funds to reduce the amount of external borrowing. Otherwise the amount will be only £2 million.

ELECTRICITY GENERATED AND PLANT INSTALLED

	Fuel consumed Thousand tons			Electricity generated Million kWh			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity G.B.... ...	3,734	88	321·3	8,402	7	8,417	7,922	25,015
North of Scotland H.E.B. ...	21	—	1·3	37	157	199	197	983
South of Scotland E.B.	286	3	0·1	553	21	574	543	1,538
Total for November, 1958 ...	4,041	91	322·7	8,992	185	*9,190	8,662	27,536
Corres. total for November, 1957	4,380	77	93·6	8,594	202	8,812	8,293	26,102
Inc. or dec., per cent	−7·7	+17·9	+244·8	+4·6	−8·7	+4·3	+4·4	+5·5
Total to date (11 months), 1958...	40,786	908	2,204·7	86,275	1,910	88,321	83,091	
Total for corres. 11 months of 1957	40,919	772	474·6	79,537	1,865	81,527	76,607	
Inc. or dec., per cent	−0·3	+17·6	+364·5	+8·5	+2·4	+8·3	+8·5	

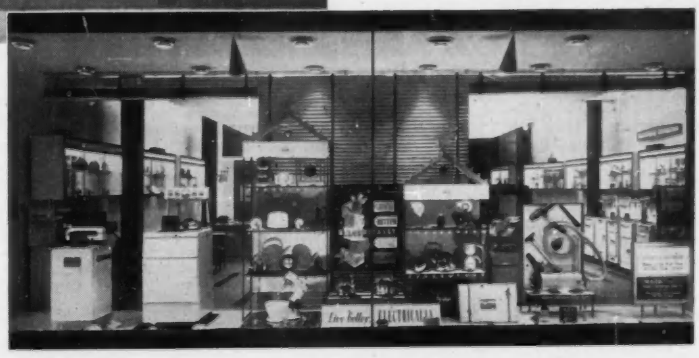
* The total figure includes generation by other methods amounting to 13 million kWh.

Power Supply in November

The November returns of electricity generated issued by the Ministry of Power show a continuation of the general trends observed in recent months. Coal consumption was down by 7·7 per cent while substantially more oil was used as fuel. Private generation by industry was again below the level of last year.

A total of 9,190 million kWh was generated by the Central Electricity Generating Board, the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board, an increase of 4·3 per cent (this compares with a rise of 5·9 per cent in October). At the end of November the total installed capacity of plant was 27,536 MW, a net addition of 158 MW during the month.

Electricity generated by industry in the four weeks ended 22nd November totalled 860 million kWh, a decrease of 3·2 per cent, the largest decline (15·8 per cent) being in the textiles, leather and clothing industries. Production at Calder Hall nuclear power station, included under the chemical industry, amounted to approximately 16 million kWh. In the 47 weeks ended 22nd November the aggregate



Two new Service Centres have recently been opened by the London Electricity Board (see "Electrical Review," 12th and 19th December, pp. 1096 and 1162). The accompanying photographs show the North Western District showrooms, Finchley Road (left) and the Western District premises at Shepherds Bush (below)

generation by industry was 9,378 million kWh, a decrease of 0·4 per cent compared with the corresponding period of 1957.

Prepayment Meter Accessibility

The London Electricity Board is being asked to give sympathetic consideration to requests of old people for the free re-positioning of prepayment meters. An official of the Metropolitan Boroughs' Standing Joint Committee said the question was first raised by Stoke Newington Council, which complained that in many cases chairs or steps had to be used to reach the meters. The Council said many pensioners were unable to afford the cost of having the meters moved.

OVERSEAS

Nigerian Corporation's First Surplus

Tariff increases which came into force in June, 1956, enabled the Electricity Corporation of Nigeria to make a profit last year for the first time since its establishment in 1951, and this improvement is expected to continue if wages and fuel costs remain reasonably stable. The Corporation's report for the year ended 31st March last shows that revenue from all sources, other than investments, rose from £2,556,494 to £3,162,086, while expenditure increased from £2,538,983 to £3,123,922, leaving a net operating surplus of £38,164. After adding interest on investments and providing for payments and adjustments in respect of previous years, etc., there was a credit balance of £65,408. The average cost per kWh sold was 3·836d. During the year the Federal Government paid the Corporation £250,000 to cover estimated deficits on amenity undertakings over a period of five years; £45,000 was appropriated for 1956-57, a further £34,379 for 1957-58, and the remainder was carried forward to support uneconomic operations in future years.

Electricity sales in 1957-58 increased by 23·4 per cent (from 158 million to 195 million kWh) compared with 17·7 per cent in the previous year. This high rate was mainly due to industrial development in the larger centres and expansion of the domestic air-conditioning load. Present prospects are that sales will double within the next four to five years. Reference is made in the report to inquiries received from potential consumers who are considering the establishment of a variety of enterprises, such as textile mills, cement factories, food factories, etc.

A further 8·5 MW of generating plant was brought into operation during the year and 37 MW was under construction. At 31st March last the aggregate plant capacity was 94 MW. Because of the increasing cost of coal it was decided to convert the boilers at Ijora "B" power station to oil burning and a very substantial saving is anticipated.

Proposed Dungeness Nuclear Station

A PUBLIC inquiry was held last week at Lydd into the proposal of the Central Electricity Generating Board to build a £60 million nuclear power station at Dungeness and erect transmission lines from Dungeness to Lydd. The inquiry was conducted by Mr. H. W. Grimmitt, chief engineering inspector of the Ministry of Power, and Mr. W. A. Devereux, senior planning inspector of the Ministry of Housing and Local Government. The 20 to 30 objectors to the scheme included the Kent County Council and the Nature Conservancy.

Mr. S. B. R. Cooke, who presented the case for the Generating Board, referred to a booklet published by the Nature Conservancy setting out their objections to the scheme. At the best the book was obscure, he said, and at the worst it was equivocal, evasive and disingenuous. How the Conservancy justified this ill-advised and ill-informed incursion into matters which were quite outside their functions it was difficult to understand.

Explaining the project, Mr. Cooke said that the Board wished to acquire about 225 acres west of Dungeness Point and a further 11 acres for an access road. Almost all the land belonged to Mr. G. T. Paine, who had the previous night withdrawn his objection to a compulsory purchase order. There was under construction a cross-Channel link and it was proposed that there should be a sub-station at Lydd and also a connection between Lydd and Canterbury. Agreeing that the Dungeness district was of interest to ornithologists, physiographers, botanists and others, he said that in regard to all of them it was a question of the Board's having a very small percentage of a considerable area, except for the bird observatory.

Mr. D. Clark, chief planning engineer to the C.E.G.B., said that the electricity produced at Dungeness would have an annual value of £9 million. The rateable value of the station would be £140,000. The site was of outstanding suitability and the amount of harm done to minority interests would be relatively small by comparison with most sites that could be found. The Board had considered the whole of the Kent coast line in its search.

Mr. F. R. Farmer, head of the Reactor Safety Division of the United Kingdom Atomic Energy Authority, said that reactors were so designed that they could be shut down immediately and, in an emergency, automatically. Replying to questions, he said that in the event of a serious accident it might be necessary to evacuate people from within an area of about 100 yards from the station. After 20 to 40 years the reactors would be sealed up.

Mr. E. M. Nicholson, director general of the Nature Conservancy, said they had no quarrel with the Generating Board. They were all consumers of electricity and had an interest in the success of the Board's work. But they also wanted to leave something of their inheritance for their children. He regretted Mr. Cooke's remarks on the opening day, which he described as a classic example of how relations between two great bodies should never be conducted. The Minister should be helped to write into his decision whether the Dungeness case was a departure from the assurances he had given that places of scientific and other special interest would not be chosen for power station sites.

Mr. P. Conder (Royal Society for the Protection of Birds) said they were greatly distressed that the area had been chosen for the station.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 3rd January:

ACEC. No. 770,168. Class 7. Electric generators, dynamos, motors (not for land vehicles), alternators, pumps, hoisting gear (not for boats), hydraulic turbines, machines for mechanical handling, etc. **ACEC.** No. 770,169. Class 9. Electrical and electronic apparatus and instruments, domestic electrical appliances and laboratory apparatus; instruments for measuring and detecting radiation; signalling apparatus, telecommunication apparatus, sound recording and reproducing apparatus; spectrographs, electric resistances, experimental furnaces, electric batteries, photo-electric cells, oscillographs, insulated electric wire, electric cables, conduit material, sockets, switches, vacuum and gas-filled electronic tubes; tachometers; and apparatus for use in connection with nuclear reaction processes and radioactivity. **ACEC.** No. 770,170. Class 10. Electric lamps for surgical or curative purposes; X-ray tubes; and apparatus for giving medical treatment by means of ultrasonotherapy. **ACEC.** No. 770,171. Class 11. Electric heating and electric lighting apparatus; domestic electrical appliances and furnaces (other than experimental furnaces). —Ateliers de Constructions Electriques de Charleroi, Brussels, Belgium. Address for service, c/o Feeny & Feeny, 22, Buckingham Gate, Westminster, S.W.1.

No. 778,096 (design). Class 9. Switches, flat irons, vacuum cleaners, telephonic apparatus and instruments, batteries, bells and connections, all being electrical goods. No. 778,097 (design). Class 11. Heating and lighting installations, electric fires, lamps and refrigerators.—Technische Unie Heybroek-Zelander N.V., Amsterdam, Holland. Address for service, c/o J. Owden O'Brien & Son, 53, King Street, Manchester, 2.

Pizz-O-Mat. No. 779,920. Class 9. Electrical apparatus and instruments and parts. **Pizz-O-Mat.** No. 779,921. Class 11. Electrical installations for cooking and parts.—Rotiss-O-Mat, Ltd., 101, Farm Lane, S.W.6.

Ekco. No. 777,256. Class 17. Pipes and tubes; and pipe couplings, wall plugs, insulators, draught excluders, insulating brushes (electric), etc., all made of plastics.—E. K. Cole, Ltd., Ekco Works, Priory Crescent, Southend-on-Sea.

NEW ELECTRICAL EQUIPMENT

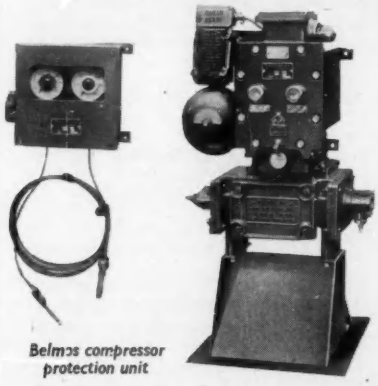
Glass Fibre Banding Tape

Tapes of non-woven parallel glass yarns impregnated and bonded with a fully catalysed polyester for armature banding and similar applications, manufactured by the Chicago Printed String Co., are now available in this country from P. P. PAYNE & SONS, LTD., Haydn Road, Nottingham. The tape is supplied in the semi-cured state and requires no interleaving, curing being effected by baking at 125 deg C for 4½ hours. When cured the tape is unaffected by a continuous operating temperature of 150 deg C, and it can withstand up to 260 deg C for short periods.

Compressor Protection Unit

The ALR unit recently introduced by the BELMOS CO., LTD., Bellshill, Lanarkshire, gives automatic protection against compressor overheating in addition to audible and visible warning. A number of protection points can be incorporated, and it can be used with a wide variety of hand and automatic starters—including those fitted with control at line voltage as well as those with intrinsically safe control circuits—or any type of remote automatic switch to give warning of a dangerous condition and stop the motor concerned. The equipment is contained in two separate housings, the main enclosure, certified flameproof by the Ministry of Power for Group I gases, has two compartments. These contain the isolating switch and the relays and 15 V transformer supplying the operating current for the intrinsically safe alarm bell and thermometer unit circuits. The latter is housed in a steel case mounted on or near the compressor.

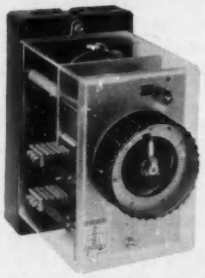
The two thermometers, which can be set to operate at any given temperature, are connected to the compressor by flexible steel capillary tubes and the temperature indicating dials and setting pointers are visible through an armoured glass window in the case. When a temperature rise beyond the pre-set limits occurs in the compressor, the alarm bell rings and simultaneously the compressor motor is switched off. The motor cannot be re-started until the temperature falls below the pre-set level.



Belmos compressor protection unit

Process Timer

A new timer produced by ENGEL & GIBBS, LTD., Warwick Road, Boreham Wood, Herts., has five timing ranges: 0·3 to 6 seconds, 3 to 60 seconds, 0·3 to 6 minutes, 3 to 60 minutes and 0·3 to 6 hours. Range changing is carried out by a small selector screw with fine adjustments made by a large indicator dial, marked in various degrees of timing. The moulded Bakelite base houses the various terminals for external connections, and the whole assembly is enclosed in a clear Perspex dust-proof cover. A synchronous motor and clutch mechanism is incorporated, and four change-over contacts, rated for 6 A 230 V a.c., are fitted, any one of the four contacts being isolated by a selector. The timer, which has outside dimensions of 6in by 6in by 3in, is accurate to ¼ per cent of any set time.



Engel & Gibbs process timer

Fluorescent Lamp Chokes

H. W. FIELD & SON, LTD., Harold Wood, Essex, announce that a new filling is being used in their present production of 80 W fluorescent lamp chokes. With this material, known as "Resincast," the core and coils of the choke are cast into a solid block of filling inside the case. It is claimed to have excellent thermal properties and the choke operates at a lower temperature. A new method of internal construction also permits the size of the choke to be kept to the minimum. The company states that the new filling cannot soften; it actually becomes harder with age and heat.

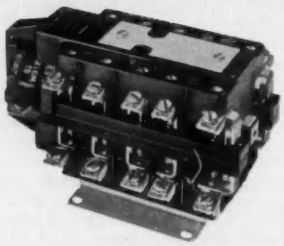
Sealed Transformers and Chokes

A range of hermetically sealed C-core transformers and chokes, designed and constructed to comply with Inter-Service specifications RCS 214 and RCL 215, has been announced by STANDARD TELEPHONES & CABLES, LTD., Rectifier Division, Edinburgh Way, Harlow, Essex. Coils are wound on bobbins or central tubes with fabricated or moulded end cheeks. Multiple loops of grain-oriented silicon iron strip are cut to form C-cores. To obtain and retain maximum contact at the magnetic faces, the two half loops, after insertion into the coil bobbins, are banded with steel strip in tension. The terminals formed from inorganic insulation are selected and fitted according to specified peak working voltages in relation to operating conditions.

The two-part cases, which are constructed from hot tinned deep drawn steel with the overlapping joint soldered, are suitable for upright or inverted mounting. Four steel fixing screws with slotted hexagon heads and pin and tab washers are supplied with each unit. A secure metal data plate detailing ratings and terminal positions is fixed to each case, which is normally finished matt black.

Industrial Control Relays

A range of industrial control relays, designated Class 8501 Type D, has been introduced by SQUARE D, LTD., 100, Aldersgate Street, London, E.C.1, covering contact arrangements from 2 to 10 circuits. The mechanical duty capabilities are in excess of the most severe category in B.S. 775 : 1956, i.e. mechanical duty class IV, and all models are rated for a current carrying capacity of 10 A at 600 V a.c. Mounting hole dimensions of 2⅛in by 2¼in on the base plates for all relays in the range are identical, only one template being necessary for the drilling of the panel.



Square D relay

Terminals are provided with positive pressure wire connectors and are completely accessible from the front. Silver to silver, double break contacts, incorporating a self-wiping action, are visible for inspection without removing any parts, and the relay can be serviced, without removal from its panel mounting, by loosening two screws. Moulded coils are incorporated which have a low rate of moisture absorption, and positive pressure connectors are used on the coil terminals.

Financial Section

STOCKS and SHARES

FOR the investor, 1958 has proved to be a very much better year than seemed at all likely twelve months ago. Opening with Bank Rate at 7 per cent, and with American trade running strongly into recession, the Stock Exchange got away to a dismal start. By February, the average of industrial share prices had sunk to the lowest level for three or four years. A month later came the first of the five cuts which brought the Bank Rate down, eventually, to 4 per cent. Prices began to rise as Government policy moved more obviously across from the restraints of the credit squeeze to the stimulation of re-expansion. With such encouragements as the freeing of Bank lending and credit facilities, the easing of purchase tax and hire-purchase regulations, and the enlargement of the capital investment programmes of the State industries, the upward movement in the industrial market scarcely faltered. It easily topped the previous peak of 1957, and by the closing stages, share prices had established, on the average, an appreciation of something like 30 per cent over the year as a whole.

British Electricity Stocks

For much of the past year the gilt-edged market steadily gathered strength, but in the last quarter the progressively stimulating character of Government policies had the effect of increasing the competitive attractions of ordinary shares and also, it seemed, of raising some apprehension about a possible revival of inflationary tendencies. Prices of Government stocks retraced some of the ground gained, but ended nevertheless with some useful improvements. In the five principal British Electricity issues the gains extended to 4 or 5 points, and erased approximately the recession of the previous year.

Electrical Engineering

Among the shares of the major electrical engineering groups, experiences have been rather mixed over the past year, and seldom as favourable as those enjoyed by the sections of the market concerned more exclusively with the consumer goods affected by the relaxation of credit restrictions. As can be seen from the table, shares of A.E.I. and English Electric moved fairly closely in step with each other in improving in value by more than 20 per cent. A. Reyrolle and Crompton Parkinson (assisted by a scrip issue and a larger dividend) also appreciated, and G.E.C. picked up well in the last month or two. Of

Company	Price 1958		Change
	Jan.	Dec.	
A.E.I.	47/6	58/-	+10/6
John Thompson	25/-	25/-	—
G.E.C.	37/6	39/3	+1/9
Simon-Carves	25/-	31/6	+ 6/6
English Electric	47/6	60/-	+12/6
C. A. Parsons	52/6	54/6	+ 2/-
Reyrolle	80/-	92/3	+12/3
Head Wrightson	18/6	25/-	+ 6/6
Clarke Chapman	67/6(c)	63/-	— 4/6
Crompton Parkinson	10/-(c)	12/6	+ 2/6
Richardsons Westgarth	14/9	14/3	+ 6d
Int. Combustion	21/-	27/6	+ 6/6

Note: (c) Adjusted for scrip issue.

shares in the engineering firms associated with these companies in the principal nuclear power groups, there were good performances from International Combustion, Simon-Carves and Head Wrightson.

Equipment and Manufacturing

In the general fields of electrical equipment manufacturing, many shares prospered well in the general advance of industrial investments. Scrip issues and dividend increases were not uncommon and reacted favourably on the shares concerned. Company reports have often been distinctly cautious on the subject of profit margins and intensified competition, and recently published financial results have continued in many cases to be affected by the restraints imposed by the credit

Company	Price 1958		Change
	Jan.	Dec.	
Brook Motors	28/3(c)	44/6	+16/3
Crabtree Elec.	24/3	31/3	+ 7/-
Dewhurst	7/6	8/-	+ 6d
Elec. Construction	22/6	28/6	+ 6/-
Hackbridge & Hewittic	11/3	13/9	+ 2/6
Lancs. Dynamo	32/6	44/6	+12/-
Laurence, Scott	14/3	16/3	+ 2/-
Switchgear & Cowans	4/9(c)	9/-	+ 4/3
Ward & Goldstone	24/-	37/3	+13/3
Allen West	8/3(c)	12/9	+ 4/6
Westinghouse Brake	32/6	44/6	+12/-

Note: (c) Adjusted for scrip issue.

squeeze. Relief from the latter has, of course, been welcomed as an aid to optimism in the outlook in the coming year.

Cables and Telephones

Shares of the leading cable manufacturers recovered much of their popularity. A helpful influence was the development of greater stability in the copper price; the previous slump and erratic fluctuations had, for a year or two previously, been a considerable influence upon company earnings. Evidence of surplus capacity in the industry attracted attention, and

Company	Price 1958		Change
	Jan.	Dec.	
Aberdare Holdings	10/6	15/9	+ 5/3
Automatic Telephone	57/6	75/-	+17/6
B.I.C.C.	40/3	52/3	+12/-
Dictograph Telephones	5/6	7/-	+ 1/6
Enfield	12/9	15/6	+ 2/9
Ericsson Telephones	19/3	26/3	+ 7/-
Hackbridge Holdings	10/6	15/3	+ 4/9
J. & P.	18/9	19/-	+ 3d
L.E.W.	41/3	62/-	+20/9
T.C. & M.	23/6	37/6	+14/-
Telephone Mfg.	5/6	4/9	— 9d

a great deal of interest was consequently aroused by the mergers completed between A.E.I. and W. T. Henley's, and proposed by B.I.C.C. and Telegraph Construction. Telephone manufacturers' shares were generally well supported.

Domestic and Other Equipment

A 75 per cent rise in the price of Hoover shares over the year was an outstanding instance of investment reactions to the easing of credit and

Company	Price 1958		Change
	Jan.	Dec.	
British Tabulating	33/-(c)	57/6	+24/6
Chloride Elec.	57/6	65/9	+ 8/3
E. K. Cole	16/9	16/9	—
Cossor	5/-	7/-	+ 2/-
Decca "A"	24/6	36/9	+12/3
E.M.I.	21/-(c)	50/-	+29/-
Elliott-Automation	12/-	16/9	+ 4/9
Ever Ready	14/-	22/9	+ 8/9
Hoover	32/6	57/6	+25/-
Lucas	28/-	43/9	+15/9
Morphy-Richards	15/-	19/6	+ 4/6
Plessey	60/-	70/6	+10/6
Pye	12/6	15/-	+ 2/6
S. Smith	7/3	12/-	+ 4/9
Thorn Elec. "A"	21/3	24/9	+ 3/6

Note: (c) Adjusted for scrip issue.

hire-purchase terms in the field of domestic appliances such as washing machines, refrigerators and heaters. The more than doubling of the price of E.M.I. shares was one of the year's outstanding features, based on excellent financial results and a prospect of increased dividends in the coming year. Several radio shares did well, particularly those with commercial television interests, and there was rising interest in the makers of electronic and automation equipment such as British Tabulating Machine and Elliott-Automation. Big improvements in the shares of Lucas, S. Smith and many motor car accessories firms reflected the booming output returns from the motor industry.

Present Yields

On the whole, there has been a rather greater degree of liberality during the past year in dividend distributions. Nevertheless the effect of the big rise in share prices, coupled with the general fall in interest rates, was to reduce sharply the level of yields available from industrial investments. Whereas it was not difficult a year ago to invest on a 6 per cent yield basis in many high-grade industrials, it has become increasingly difficult to obtain as much as 5 per cent on the money from shares in that category. Yields are a good deal lower than that in cases where either the dividend cover or the "growth" characteristics are considered to be out of the ordinary, but returns of 6 to 7 per cent still appear fairly plentifully in the electrical lists.

On account of the Christmas holiday we are unable to publish our share list. It will appear as usual in next week's issue of the *Electrical Review*

REPORTS and DIVIDENDS

The British Electric Resistance Co., Ltd.—The annual meeting was held on 15th December, Mr. H. Paul-Huhne (chairman) presiding. In his statement, which had been previously circulated, the chairman said that the relaxation of restrictions in bank overdraft facilities, coupled with the assistance they had received from their bankers, had removed the necessity, at present, for inviting subscriptions for additional capital, and the proposed scrip issue was intended merely to bring the issued share capital more into line with the true value of the net assets of the company. The board had no intention of making, in the immediate future, any increase in the total annual amount distributed by way of dividend.

During the year the integration of the parent company and the main subsidiary—British Power Transformer Co., Ltd.—was carried through, whereby all fixed assets of the subsidiary were acquired by the parent company, and the activities of the subsidiary were, in general terms, now restricted to sales and allied activities.

Overseas markets continued to present many difficulties, but the new arrangements they had been able to make in Australia were beginning to show promising results. The display of their products at the Hanover Fair was already beginning to have a marked effect upon the volume of their exports to Europe.

With regard to the current year, they had started with a good order book and the sales to date were normal. They anticipated the introduction and marketing of new lines during the year.

Radio Rentals, Ltd., reports a group profit for the year ended 31st August last of £1,736,887, as compared with £1,322,900 for 1956-57. A sum of £911,947 is provided for taxation, and the net profit is £824,940 (against £605,719). It is proposed to pay a final dividend of 10 per cent on £2,000,000 capital, which with the interim dividend of 10 per cent on £1,000,000 capital, makes 20 per cent for the year. For the previous year the total distribution was 30 per cent on £898,127 capital. It is also proposed to pay a special interim dividend in respect of 1958-59 of 5 per cent.

H. J. Baldwin & Co., Ltd., have decided to issue the unissued balance of 650,000 2s ordinary shares at 4s each. These shares are to be taken up for cash by Hartley Baird, Ltd., a subsidiary of Camp Bird, Ltd. The proceeds of the issue (£130,000) will be applied as to £65,000 in the purchase from Hartley Baird of 10,714 £1 shares in Duratube & Wire, Ltd., and as to the balance in the purchase from Hartley Baird of 471,440 1s ordinary shares in Hartley Electromotives, Ltd. Both are private concerns and are at present wholly owned subsidiaries of Hartley Baird. The interest to be purchased in each case amounts to 30 per cent of the total issued capital. Arrangements are being negotiated for marketing Duratube products among certain classes of customers with which Baldwin is in close touch either through a separate Baldwin cable division or through a marketing company, 70 per cent to be owned by Baldwin and 30 per cent by Hartley Baird.

British Aluminium Co., Ltd.—An extraordinary meeting of Tube Investments will be held on 12th January to increase the capital of Tube Investments by £4,250,000 as a further step towards gaining control of the British Aluminium Co. Sir Ivan Stedeford, chairman of Tube Investments, states that it is because his directors believe that stockholders of British Aluminium will wish to continue their association with the United Kingdom aluminium industry, and to participate in the benefits of the proposed merger, that they have decided to offer not only cash, but also shares in T.I. for the capital of British Aluminium. With the proposed increase in capital of Tube Investments, the unissued ordinary capital, following completion of the deal, will be approximately the same as at present. Tube Investments states that, except for the issue of shares in response to the offer, the directors have no present intention of issuing any other new shares.

Murex, Ltd., has announced an interim dividend of 5 per cent (against 7½ per cent). The directors state that the sharp decline in overall demand for the metallurgical products of the parent company experienced in the closing months of 1957-58 has continued during the past six months due to the further recession in the ferrous and non-ferrous industries. There are few signs of any marked improvement in the demand for the principal products and competition continues to be severe. The demand for welding electrodes and equipment has been well maintained, and the trading results of Murex Welding Processes are satisfactory. Expenditure on the modified capital programme will be met from present resources and the accommodation made available by bankers; it has not been necessary so far to draw upon this accommodation. In these circumstances the Treasury has extended the period of consent to the raising of additional capital until 12th December, 1959. No action is expected for the time being.

R. A. Lister & Co., Ltd., report that, subject to final audit, the group profit for the year to 30th September last is £1,074,972, as compared with £1,079,136 for the preceding year. Taxation absorbs £586,852, and the net balance is £488,120 (against £475,939). It is proposed to pay a final dividend of 10 per cent (against 7½ per cent), making 12½ per cent (10 per cent) for the year.

Oldham & Son, Ltd., have declared an interim dividend of 7½ per cent (unchanged).

Bulpitts (Swan Brand), Ltd., has declared an interim dividend of 5 per cent for the period since incorporation to 31st December.

Lightfoot Refrigeration, Ltd., is paying an interim dividend of 3 per cent (unchanged).

Pinchin, Johnson & Associates, Ltd., are paying an interim dividend of 5 per cent (unchanged).

New Companies

International Rectifier Company (Great Britain), Ltd.—Registered 10th December. Capital £300. Electrical, mechanical, hydraulic and general engineers, and manufacturers of and dealers in machinery, etc. Directors: D. C. Lorkin, A. Newing and E. Lidow. Regd. office: St. Stephens House, Victoria Embankment, S.W.1.

Peter Scott (Exeter), Ltd.—Registered 31st October. Capital £2,000. Manufacturers of and dealers in television, radio and telephone apparatus, etc. Directors: P. T. Scott and P. P. Scott. Regd. office: 20, South Street, Exeter, Devon.

Grange Electrical Co. (Yeadon), Ltd.—Registered 3rd November. Capital £3,500. To acquire the business of electrical engineers and contractors carried on by F. Hargreaves as the Grange Electrical Co., at Yeadon, etc. Directors: W. V. Taylor and R. L. Taylor. Regd. office: Grange Works, Grange Avenue, Yeadon, Yorks.

Steele Brothers (Newcastle, Staffs.), Ltd.—Registered 4th November. Capital £1,000. Electricians, electrical contractors, electrical and mechanical engineers, television and radio engineers, etc. F. Steele signs as director. Solicitors: Knight & Sons, Newcastle-under-Lyme, Staffs.

Rays Service (Herne Hill), Ltd.—Registered 3rd November. Capital £5,000. Manufacturers of and dealers in electrical apparatus and equipment, etc. Directors: R. G. Brown and Mrs. Betty Brown. Regd. office: 23, Norwood Road, S.E.24.

Bankruptcies

H. F. Mouncey, 4, Cromer Road, Tooting, London, S.W.17, electrical engineer.—Application for discharge to be heard on 15th January at the County Court, Scarbrook Road, Croydon.

A. J. L. Fleming, 54, Fore Street, Buckfastleigh, Devon, electrical engineer.—Order made 18th November suspending discharge for fourteen days (discharged as from 2nd December, 1958).

G. B. Solomon, 57, Fore Street, St. Columb, Cornwall, trading as St. Columb Radio, radio and electrical dealer.—Last day for receiving proofs for dividend 30th December. Trustee, Mr. J. E. Ellis, 50, The Terrace, Torquay.

C. Sykes, 10, High Kepplewray, Broughton-in-Furness, Lancs., electrician.—Supplemental dividend of 7⅞d in the £, payable at the Official Receiver's Office, 14, Lowther Street, Carlisle.

R. Collier, lately trading at 4, The Crescent, Littleham, Exmouth, Devon, as a refrigeration and electrical engineer, and formerly trading in partnership with another under the style of Collier & Slater at 4, The Crescent, Littleham, and 108, Victoria Road, Exmouth.—First and final dividend of 1s 5d in the £, payable at 12, Pennsylvania Road, Exeter.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

10227. Pye, Ltd.—Colour television transmitting apparatus. 7th April, 1955. (Cognate application 18553, 24th June, 1954.) (806501.)

12814. Griffith, R. G.—Telegraph type-printing apparatus. 5th July, 1955. (806433.)

18734. Siemens Edison Swan, Ltd.—Fluorescent materials. 3rd June, 1955. (806191.)

25948. Evershed & Vignoles, Ltd.—Electrical remote indicating and repeating systems. 2nd September, 1955. (806514.)

29447. Electric & Musical Industries, Ltd.—Electrical impedance matching transformers. 13th October, 1955. (806504.)

37604. Sylvania Electric Products, Inc.—Electromagnetic coils. 29th December, 1954. (806451.)

1955

1425. Slee, K. V.—Electrical pressure welding machines. 17th January, 1956. (806435.)

4189. Plessey Co., Ltd.—Electromagnetic solenoids. 31st January, 1956. (806472.)

4646. Combustion Engineering, Inc.—Tubular panel type steam superheaters or reheaters. 16th February, 1955. (806516.)

5889. Evershed & Vignoles, Ltd.—Remote indicating systems. 17th February, 1956. (806515.)

9602. Automatic Electric Laboratories, Inc.—Electronic distributor. 1st April, 1955. (806304.)

11100. Industrial Research Products, Inc.—Transducing devices. 18th April, 1955. (806305.)

12515. General Electric Co.—Neutron detectors. 29th April, 1955. (806306.)

18802. Igranic Electric Co., Ltd.—Electrical heaters. 29th June, 1955. (806221.)

18872. Brentford Transformers, Ltd.—Safety devices for electrical control gear. 25th September, 1956. (806454.)

19075. Standard Telephones & Cables, Ltd. (Lorenz A.G., C.).—Disconnectible selective call receiver. 1st July, 1955. (806222.)

19419. Griffith, R. G.—Type-printing telegraph apparatus. 5th July, 1955. (Divided out of 806433.) (806434.)

20302. Telephone Manufacturing Co., Ltd.—Polarised electromagnetic devices. 12th July, 1956. (806455.)

24476. General Electric Co.—Semiconductor devices. 25th August, 1955. (806505.)

25903. Thorn Electrical Industries, Ltd.—Lanterns. 28th August, 1956. (806444.)

26432. Igranic Electric Co., Ltd.—Rheostat control systems. 15th September, 1955. (806456.)

27951. Reyrolle & Co., Ltd., A.—Control systems for nuclear reactors. 28th September, 1956. (806409.)

30152. Ateliers de Constructions Electriques de Charleroi.—Mechanism for ensuring secrecy of communications in the magnetic recording of sound at a distance. 21st October, 1955. (806308.)

31635. Siemens Edison Swan, Ltd.—Key senders of the kind used in automatic telephone and like signalling systems. 24th October, 1956. (Addition to 730391.) (806309.)

31755. International Business Machines Corporation.—Diode clipping circuit. 7th November, 1955. (806223.)

32633. International Business Machines Corporation.—Electronic data processing machines. 15th November, 1955. (806506.)

33238. Non-destructive sensing of the state of magnetic cores. 21st November, 1955. (806458.)

34933. London Electrical Manufacturing Co., Ltd.—Production of ceramic capacitors. 28th February, 1957. (806224.)

1956

2396. General Electric Co., Ltd.—Etching of semiconductors. 2nd January, 1957. (806346.)

2918. Rheostatic Co., Ltd.—Temperature control systems. 15th January, 1957. (806171.)

4617. National Research Development Corporation.—Induction motors. 4th February, 1957. (806486.)

6017. Allison, A.—Electric driving of hydraulic propellers, screws or the like. 22nd May, 1957. (806315.)

6155. Clevite Corporation.—Apparatus for magnetically recording and printing graphic symbols. 28th February, 1956. (806288.)

6228. Babcock & Wilcox, Ltd.—Conduit systems. 27th February, 1957. (806266.)

8146. United Kingdom Atomic Energy Authority.—Heterogeneous nuclear reactors. 7th March. 1957. (806460.)

8815. Baier, O., Baier, L., Baier, W., Baier, W., and Schlumprecher, E. (trading as Baier Komm.-Ges. Webasto-Werk, W.).—Thermal magnetic relays. 21st March, 1956. (806289.)

10563. British Tabulating Machine Co., Ltd.—Electrical data storage apparatus. 15th February, 1957. (806487.)

13567. Radio Heaters, Ltd.—High frequency dielectric heating. 8th March, 1957. (806248.)

16254. Standard Telephones & Cables, Ltd.—Cathode-ray tube with ion trap. 25th May, 1956. (806293.)

19491. General Electric Co., Ltd.—Manufacture of semi-conductor devices. 30th May, 1957. (806251.)

19933. Vapor Heating Corporation.—Thermostatically regulated temperature control system. 27th June, 1956. (806294.)

21068/9. Sylvania Electric Products, Inc.—Electric induction lamp. 6th July, 1956. (806518/9.)

23193. British Broadcasting Corporation.—Circuits for colour television. 3rd June, 1957. (806391.)

23226. United Kingdom Atomic Energy Authority.—Nuclear reactors. 27th June, 1957. (806490.)

24763. United-Carr Fastener Corporation.—Electrical switch assemblies. 13th August, 1956. (806270.)

25594. Bosch G.m.b.H., R.—Commutators. 22nd August, 1956. (806254.)

26271. Beswick, D. G. E., Beswick, K. E., and Melbourn, W. F.—Electric fuses. 5th July, 1957. (806477.)

28163. General Electric Co.—Combustion chambers. 14th September, 1956. (806349.)

28948. Siemens Edison Swan, Ltd.—Fluorescent materials. 3rd June, 1955. (Divided out of 806191.) (806192.)

29287/8. Corning Glass Works.—Electrical resistor and method. 25th September, 1956. (806189/90.)

30638. Geneslay, R. H. J.—Electromagnetic damping devices. 8th October, 1956. (806331.)

30838. Standard Telephones & Cables, Ltd. (International Telephone & Telegraph Corporation).—Condenser timed delayed signal repeater. 10th October, 1956. (806361.)

31778. Sylvania Electric Products, Inc.—Exhaust machines for electric discharge devices. 18th October, 1956. (806507.)

34300. Standard Telephones & Cables, Ltd.—Information recording or sensing system. 9th November, 1956. (806274.)

37208. Spodig, H.—Magnetic separators. 5th December, 1956. (806420.)

38773. Sylvania Electric Products, Inc.—Electric induction lamp. 19th December, 1956. (806520.)

38872. General Electric Co.—Frequency multipliers. 20th December, 1956. (806423.)

39226. Siemens-Schuckertwerke A.G.—Composite conducting bars for a.c. machines. 24th December, 1956. (806424.)

1957

66. Philips Electrical Industries, Ltd.—Radiation sensitive devices. 1st January, 1957. (806334.)

246. Ericsson Telephones, Ltd.—Time-base circuits. 2nd January, 1957. (806367.)

711. Westinghouse Electric International Co.—Members prepared from cobalt base alloys. 8th January, 1957. (806183.)

2783. Western Electric Co., Inc.—Magnetic recording apparatus. 25th January, 1957. (806336.)

3225. Standard Telephones & Cables, Ltd.—Pulse coding arrangements for electric communication systems. 30th January, 1957. (806397.)

3827. Siemens & Halske A.G.—Electronic counting networks. 4th February, 1957. (806276.)

4567. Mallory & Co., Inc., P. R.—Flared electric switch contact structure. 11th February, 1957. (806425.)

8783. Westinghouse Electric International Co.—Electric circuit interrupters. 18th March, 1957. (806229.)

9292. Telefunken G.m.b.H.—Rectifier circuit arrangements using transistors. 21st March, 1957. (806231.)

9713. Leuenberger, H.—Starting devices for fluorescent tubes. 25th March, 1957. (806185.)

9921. Vigren, S. D., Zander, R. A., and Glaesson, P. H. E.—Polarised electromagnetic devices. 26th March, 1957. (806428.)

10853. Allmänna Svenska Elektriska A.B.—Electric air blast circuit-breakers. 3rd April, 1957. (806232.)

12296. Maschinenfabrik Oerlikon.—Conduit arrangement in bipolar electrolysers. 15th April, 1957. (806376.)

13353. Bull, R. A., Coates, C., and Lardner, W. E.—Electric selective signalling systems. 26th April, 1957. (806233.)

13371. General Electric Co.—Electrolyte for an electrolytic capacitor. 26th April, 1957. (806234.)

15330. Western Electric Co., Inc.—Electromagnetically driven resonance relays. 14th May, 1957. (806509.)

17228. Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler.—Fuel element for nuclear fission reactors. 30th May, 1957. (806430.)

20213. Sylvania Electric Products, Inc.—Caps for electron tubes or other components having flexible lead-ins. 26th June, 1957. (806257.)

21817. United Kingdom Atomic Energy Authority.—Electric emergency switches. 10th July, 1957. (806258.)

25207. Philips Electrical Industries, Ltd.—Colour television cathode-ray tubes. 9th August, 1957. (806510.)

1958

14476. Slee, K. V.—Electrical pressure welding machines. 17th January, 1956. (Divided out of 806435.) (806436.)

24259. Combustion Engineering, Inc.—Tubular panel type steam superheaters or reheaters. 16th February, 1955. (Divided out of and addition to 806516.) (806517.)

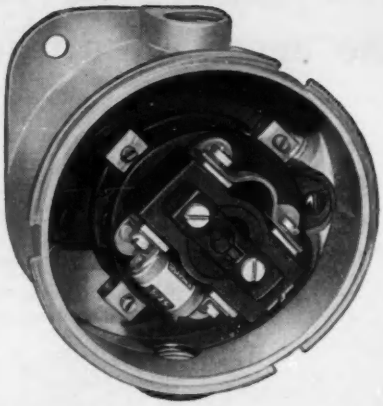
26229. Sylvania Electric Products, Inc.—Methods of making electromagnetic coils. 29th December, 1954. (Divided out of 806451.) (806452.)

Designed for safe outdoor use in exposed positions, such as docks, wharves, shipyards and railway yards, this Siemens Ediswan fused switch is contained in a cast iron case and is completely watertight. The bayonet-fitting lid has a rubber gasket seal and cannot be removed with the switch in the ON position.

The rotary-action double-pole double-break switch is mounted on a non-track Bakelite moulding which can be simply removed from the case. Terminals are easily accessible and all live parts are shrouded by a Bakelite cover plate.

Tested by immersion for 15 minutes in 12 ft. of water, equivalent to 5.2 lb/sq. in.

COMPACT · ROBUST · GUARANTEED WATERTIGHT



SIEMENS EDISWAN

Water tight

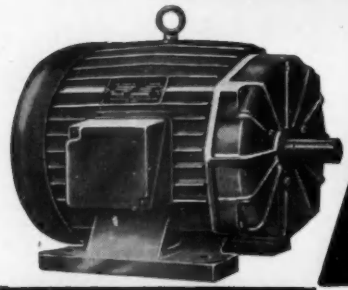
IRONCLAD FUSED SWITCH

SIEMENS EDISON SWAN LTD. *An A.E.I. Company*

Distribution Equipment Division, Upper Thames Street, London EC4

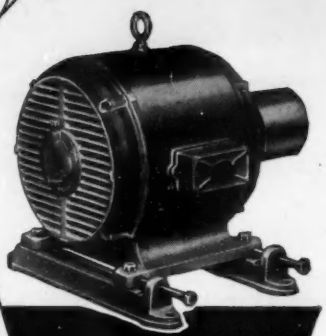
Telephone: Central 2332 Telegrams: Sieswan Cent London

STANDARD—



PLUS

SLIP RING MOTOR with removable screen protected slip rings for two and three phase supplies. ¼ - 45 H.P.



TOTALLY ENCLOSED high performance motor with low temperature rise and high torque characteristics. ¼ - 40 H.P.

STANDARD or SOVEREIGN high torque motors, lift and crane ratings, flange or skirt ring mountings. ¼ - 50 H.P.

Most standard motors can be supplied from stock, non-standard motors supplied expeditiously.

Power by Howells means outstanding service. Rigid compliance with British Standard Specifications plus extensive manufacturing experience gives each motor the ability to withstand the most arduous service conditions.

From the HOWELLS RANGE

Catalogue and leaflets on request:

HOWELLS (ELECTRIC MOTORS) LTD. VALE PLACE WORKS, HANLEY, STOKE-ON-TRENT, ENGLAND

Branches at: LONDON · MANCHESTER · BRISTOL · BIRMINGHAM · GLASGOW · LEEDS *Please Quote* **P.101B 57.**

DUST

the enemy of efficient production

is a constant menace, damaging machinery and paintwork, as well as creating a fire risk.

DUST and DIRT can be effectively trapped and removed by using the New Welbeck Master Cleaners.

These light, portable and robust machines are designed on a "No Dust Bag" principle especially to cope with all cleaning problems in industry.

Write for further particulars or free demonstration, WITHOUT OBLIGATION, to Dept. 40.

BY APPOINTMENT TO H.M. THE QUEEN

SUPPLIERS OF VACUUM CLEANERS

McDOUGALLS use NEW WELBECK industrial suction cleaners.
The 'DUPLEX' model cleaner in use at McDougalls, cleaning the base of a plansifter.

NEW WELBECK LTD

HEAD OFFICE & WORKS Moulsecoomb Way, Brighton 7, Sussex. Tel.: Brighton 61666 (PBX)
LONDON OFFICE 6 Cavendish Square, London, W.1. Tel.: LANgham 1517 (PBX)
BRANCHES AT BIRMINGHAM, MANCHESTER, SCOTLAND & EIRE

N29

FORTHCOMING EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

EXCEPT for I.E.E. Christmas lectures for schoolchildren, there is a lull in electrical events until the New Year, and this seems an opportune time for drawing our readers' attention to arrangements which have been made for the coming months. In addition to the few meetings to be held next week, therefore, we give below some of the more important events and social functions which have been arranged for the first half of 1959. Our normal weekly list of events will be resumed in our next issue.

MONDAY, 29th DECEMBER

Salford.—Royal Technical College, 3 p.m. I.E.E. North-Western Centre. Christmas lecture for schoolchildren. "Invention and New Machines," by Dr. E. R. Laithwaite.

WEDNESDAY, 31st DECEMBER, and THURSDAY, 1st JANUARY

London.—Savoy Place, W.C.2. I.E.E. Schoolchildren's lecture. "Inventions and New Machines," by Dr. E. R. Laithwaite.

FRIDAY, 2nd JANUARY

Birmingham.—Bennett Hall, Y.M.C.A. I.E.S. Birmingham Centre. Biennial Exhibition of Lighting Fittings.

Fawley.—Copthorne House, Society of Instrument Technology, Fawley Section. "Instrumentation of the Dounreay Reactor," by K. R. Sandiford.

London.—At the I.E.E., Savoy Place, W.C.2, 2.30 p.m. The Plastics Institute. "Plastics and Electricity," by E. Rushton.

SATURDAY, 3rd JANUARY

Birmingham.—Grand Hotel, from 3 p.m. to 6 p.m. Birmingham Electric Club. Annual children's party.

Bolton.—Technical College, 3 p.m. I.E.E. North Western Centre. Christmas lecture for schoolchildren. "Invention and New Machines," by Dr. E. R. Laithwaite.

FRIDAY, 9th JANUARY

Belfast.—Grand Central Hotel. I.E.E. Northern Ireland Centre. Annual dinner-dance.

Birmingham.—Queen's Hotel. I.E.S. Birmingham Centre. Annual dinner.

Cambridge.—Dorothy Restaurant. I.E.E. East Anglian Sub-Centre. Annual dinner-dance.

Edinburgh.—Grosvenor Hotel. I.E.S. Edinburgh Centre. Annual supper and buffet dance.

SATURDAY, 10th JANUARY

Manchester.—Manchester College of Science and Technology. I.E.E. North Western Centre. Christmas lecture for schoolchildren. "Invention and New Machines," by Dr. E. R. Laithwaite.

THURSDAY, 15th JANUARY

Cardiff.—Park Hotel. South Wales Institute of Engineers. Annual dinner.

FRIDAY, 16th JANUARY

London.—Café Royal. I.E.E. Utilisation Section. Dinner-dance.

MONDAY, 19th JANUARY, to THURSDAY, 22nd JANUARY

London.—Old and New Horticultural Halls. Physical Society Exhibition.

FRIDAY, 23rd JANUARY

Coventry.—G.E.C. Ballroom, Copsewood. Coventry Electric Club. Annual ladies' night.

MONDAY, 26th JANUARY

London.—Royal Festival Hall. Institution of Electrical Engineers. Faraday Lecture. "Automation," by Dr. H. A. Thomas.

Stoke-on-Trent.—North Stafford Hotel. I.E.S. Stoke-on-Trent Group. Annual dinner.

FRIDAY, 30th JANUARY

Brighton.—Grand Hotel. E.I.B.A. Sussex Centre. Annual ball.

Newcastle-on-Tyne.—County Hotel. I.E.S. Newcastle-upon-Tyne Centre. Jubilee dinner and dance.

Northampton.—Angel Hotel, Bridge Street. Northampton and District Electrical Association. Annual dinner and dance.

FRIDAY, 6th FEBRUARY

Birmingham.—Grand Hotel. I.E.E. South Midlands Centre. Annual dinner.

Ipswich.—Great White Horse Hotel. Ipswich and District Electrical Association. Annual dinner.

Swansea.—I.E.S. Swansea Group. Jubilee ball.

MONDAY, 9th FEBRUARY

London.—Criterion Restaurant. Illuminating Engineering Society. Golden Jubilee commemoration dinner.

TUESDAY, 10th FEBRUARY

London.—Grosvenor House. Electrical Contractors' Association. Annual dinner.

WEDNESDAY, 11th FEBRUARY

London.—Dorchester Hotel. Institution of Heating and Ventilating Engineers. Annual dinner.

MONDAY, 16th FEBRUARY

London.—Dorchester Hotel. Association of Consulting Engineers. Annual dinner.

Newcastle-on-Tyne.—Old Assembly Rooms. North East Electrical Club. Ladies' night.

FRIDAY, 20th FEBRUARY

London.—Connaught Rooms, W.C.2. Incorporated Plant Engineers. Annual dinner.

Stone.—Crown Hotel. I.E.E. North Staffordshire Sub-Centre. Annual dinner.

THURSDAY, 26th FEBRUARY

London.—Grosvenor House, W.1. Institution of Electrical Engineers. Annual dinner.

Solihull.—George Hotel. I.E.E. South Midland Graduate and Student Section. Annual joint dance.

FRIDAY, 6th MARCH

Birmingham.—Grand Hotel. Birmingham Electric Club. Annual ladies' evening.

Bristol.—Hawthorns Hotel. I.E.S. Bath and Bristol Centre. Annual dinner and dance.

Manchester.—Grand Hotel. Manchester Association of Engineers. Dinner and dance.

FRIDAY, 13th MARCH

London.—Institute of Marine Engineers. Annual dinner.

TUESDAY, 17th MARCH, to SATURDAY, 21st MARCH

London.—Earls Court. Electrical Engineers' Exhibition.

THURSDAY, 19th MARCH

London.—British Electrical and Allied Manufacturers' Association. Annual general meeting and luncheon.

Dorchester Hotel. Electrical Wholesalers' Federation. Annual general meeting followed by annual dinner.

FRIDAY, 27th MARCH

London. — Connaught Rooms. Batti-Wallahs' Society. Ladies' night.

FRIDAY, 3rd APRIL

Bristol.—Grand Hotel. I.E.E. Western Centre. Annual dinner and dance.

MONDAY, 6th APRIL, to THURSDAY, 9th APRIL

London.—Grosvenor House and Park Lane House. Annual Radio Component Show.

TUESDAY, 7th APRIL, to FRIDAY, 17th APRIL

London.—Earl's Court. Factory Equipment, Heating, Ventilation and Thermal Insulation Exhibition.

FRIDAY, 10th APRIL

Leeds.—The Refectory, Leeds University. I.E.E. North Midland Centre. Annual dinner-dance.

THURSDAY, 16th APRIL

London.—Connaught Rooms. Diesel Engineers' and Users' Association. Annual luncheon.

THURSDAY, 16th APRIL, to THURSDAY, 30th APRIL

London.—Olympia. Engineering, Marine, Welding and Nuclear Energy Exhibition.

FRIDAY, 17th APRIL

London.—Association of Supervising Electrical Engineers. Annual dinner.

Palmerston Restaurant. E.P.E.A. Meter Engineers' Technical Group. Annual dinner.

WEDNESDAY, 29th APRIL, and THURSDAY, 30th APRIL

London.—Institution of Electrical Engineers. Convention on Thermonuclear Processes.

WEDNESDAY, 6th MAY

London.—Electrical Research Association. Annual general meeting and luncheon.

WEDNESDAY, 6th MAY, to FRIDAY, 8th MAY

London.—Waldorf Hotel. Materials Handling Conference.

FRIDAY, 8th MAY, to SUNDAY, 10th MAY

Folkestone.—Association of Supervising Electrical Engineers. Annual Conference.

FRIDAY, 8th MAY, to MONDAY, 11th MAY

Carlyon Bay Hotel, Cornwall.—I.E.E. Western Centre. Summer meeting.

THURSDAY, 21st MAY

London.—Institution of Civil Engineers. Annual dinner.

THURSDAY, 21st MAY, to WEDNESDAY, 27th MAY

London.—Earls Court. International Convention on Transistors and Exhibition. (Arranged by the I.E.E.)

MONDAY, 1st JUNE, to FRIDAY, 5th JUNE

Torquay.—British Electrical Power Convention.

SUNDAY, 14th JUNE, to TUESDAY, 16th JUNE

Eastbourne. — Electrical Contractors' Association. Annual conference.

FRIDAY, 19th JUNE, to FRIDAY, 26th JUNE

Birmingham.—Bingley Hall. Safety and Factory Efficiency Exhibition.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—State Electricity Commission of Queensland, Brisbane. 28th February. Gas engine driven generating plant for Barcaldine Shire Council. (E.S.B. 30591/58. Ten/36261.)*

Bootle.—Borough Council. 3rd January. Electric cables and electrical goods (form No. 13), and electric lamps (form 14), for one year from 1st April next. Borough surveyor, Town Hall.

Bristol.—Corporation Education Committee. Equipment for Mechanical and Electrical Engineering Department of the College of Technology. (See this issue.)

Camborne-Redruth.—U.D.C. 17th January. Electrical equipment and fittings (schedule No. 24), for the year ending 31st March, 1960. S. C. Wilson, clerk, U.D.C. Offices, Camborne.

Cardiff.—City Council. 5th January. Passenger lift at Quarry Hill House Old People's Home, near St. Mellons. City surveyor, City Hall.

Edinburgh.—North of Scotland Hydro-Electric Board. Electrical installation for Orrin power station and dam. (See this issue.)

Enfield.—Applications are invited to tender for the mechanical and electrical services subcontract for a new civic centre. (See this issue.)

Formosa.—Central Trust of China, Taipei. 12th January. 135 sets of 10 kVA and 15 sets of 15 kVA distribution transformers, 20 sets of deep well turbine pumps and 25 sets of dry well turbine pumps with 30 h.p. motors and accessories. (E.S.B. 30285/58/I.C.A. Ten/36309.)*

Fylde.—R.D.C. 5th January. Mercury vapour lamps and lanterns, for class "B" street lighting, Clifton, Elswick, Weeton and Westby. Surveyor, 29a, Station Road, Kirkham, near Preston.

Grimsby.—Borough Education Committee. 16th January. Electrical installation in Western Secondary School for Boys, Cambridge Road. J. V. Oldfield, borough engineer and architect, Municipal Offices, Town Hall Square.

Hertfordshire.—County Council. Applications are invited for inclusion in the Council's list of contractors for various works. (See this issue.)

Horsham.—U.D.C. 2nd January. Electrically driven centrifugal pump and starter gear at Littlehaven pumping station. Clerk to the U.D.C., Council Offices, Horsham Park.

India.—Indian Railways, Calcutta. 16th January. Remote control equipment to control switchgear for sectioning of electric traction overhead equipment. (E.S.B. 30430/58. Ten/36244.)*

Bombay State Electricity Board. 20th February. Switchgear for Koyna-Sholapur scheme. (E.S.B. 30678/58. Ten/36298.)*

London.—Camberwell Borough Council. 3rd January. Electric lamps (schedule K) and electrical fittings, cable and conduit (schedule S), period contracts. Borough surveyor, Town Hall, Camberwell, S.E.5.

Maghery (Co. Armagh).—8th January. Electrical installation in new voluntary primary school. Cosgrove & Rooney, civil engineers, 2, Molesworth Street, Cookstown, Co. Tyrone.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House. Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Morley.—Corporation. 16th January. Trunk road lighting equipment. (See this issue.)

Mynyddislwyn.—U.D.C. 12th January. Street lighting (sodium type) along about 2½ miles of class 1 road. Engineer and surveyor, Council Offices, Pontllanfraith, Blackwood, Mon.

Richmond (Yorks).—R.D.C. 7th January. Electric motors and pumps. Arnold Brooksbank & Son, consulting engineers, 48, Sunbridge Road, Bradford, 1.

Salvador.—Salvadorean Electricity Commission. One 15 MW turbo-generator for Chorrera del Guayabo hydro-electric station, extensions to transmission lines, etc. (E.S.B. 30657/58. Ten/36267.)*

La Proveeduría General de la República, San Salvador. 6th January. Telephone equipment. (E.S.B. 30729/58. Ten/36314.)*

South Africa.—Stores Department, South African Railways, Johannesburg. 9th January. Telegraph line equipment. (E.S.B. 30709/58. Ten/36263.)*

Southend-on-Sea.—Corporation. Electrical installation at Hamsel Road Primary School. (See this issue.)

ORDERS PLACED

Glasgow. — British Railways (Scottish Region). Supply and installation of telephones and associated apparatus between Hyndland and Helensburgh.—Telephone Manufacturing Co.

Scunthorpe.—Corporation. Recommended. Electrical installation work in 142 dwellings (£3,523).—Hobson & Hammond.

Sheffield.—Regional Hospital Board. Reorganisation of the electrical installation at the Chaucer Ward of the Fir Vale Infirmary (£7,787).—Ratcliff (Electric).

South Shields.—Corporation Education Committee. Electrical installation work in a new wing at the Marine and Technical College (£5,436).—Ramsay & Son.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Addlestone (Surrey).—Scheme for civic centre, Station Road/Crockford Park Road site, for Chertsey U.D.C.; A. R. Herbert, clerk, Urban Council Offices.

Bangor.—Houses (50), Eithinog estate; borough surveyor.

Birkenhead.—Eleven-storey block of flats, Grosvenor Street, two eight-storey blocks, Mersey Mount, and two eleven-storey blocks, Woodchurch estate; borough architect, 3, Conway Street.

Birmingham.—Works, Rea Street; Phosphor Bronze Co., Ltd., Bradford Street.

Aged persons' hostel, Yardley (£95,000); Geo. Stubbings, Ltd., Streetley Road.

Stores, Marston Drive, Kingshurst Hall estate, for F. W. Woolworth & Co., Ltd.; E. Woodbourne, company architect, 1, New Bond Street, London, W.1.

Chelmsford. — Erection of Westlands County Secondary School (£130,000); H. Conolly, county architect, County Hall, Chelmsford.

Chichester.—Extensions to County Hall (£55,000); West Sussex county architect, County Hall, Chichester.

Dudley.—Works extensions; B.A.L., Ltd., Oakeywell Street.

Durham.—Church, Sherburn Road; Waring & Netts, architects, 36, Jesmond Road, Newcastle-on-Tyne.

Further additions to carpet factory for Mackay & Co., Ltd.; Cordingley & McIntyre, architects, Owengate, Durham.

School, Hurworth (£109,000); G. Stephenson, Ltd., builders, Chester Street, Bishop Auckland.

Ealing.—Flats and maisonnettes (122), Northolt Park estate; E. J. Cope-Brown, town clerk, Town Hall, Ealing, W.5.

Egham.—Laboratories for Strodes School; county architect, County Hall, Kingston-on-Thames.

Gloucestershire.—Further phase of North Gloucestershire Technical School, Cheltenham (£151,938), and construction of Tewkesbury County Secondary School for Girls (£124,920); S. E. Urwin, county architect, Shire Hall, Gloucester.

High Wycombe.—Additional wards, General Hospital; Powell & Moya, architects, 36, Great Smith Street, London, S.W.1.

Kingston-upon-Thames.—Large extensions to County Hall proposed (£225,000); Surrey county architect, County Hall, Kingston-on-Thames.

London.—Factory, Old Woolwich Road and Lassell Street, Greenwich, for William Hughes & Son, Ltd.; Charles Living, architect, 233, Leytonstone Road, E.15.

Maisonnettes (30) and flats (46), Brockley Road, Deptford; borough engineer.

Eighteen-storey hotel, Park Lane and Brick Street, Mayfair; A. V. Pilley, architect, 7, Hill Road, N.W.8.

Day hospital, physiotherapy and occupational therapy unit, kitchens, etc., as first phase development of St. Luke's Hospital, Chelsea (£104,000); R. Mellor, architect, South West Metropolitan Regional Hospital Board, 76, Wimpole Street, W.1.

Extensions to United Service Club, 116, Pall Mall, S.W.1; Thompson, Walford & Fielder, architects, Leadenhall Buildings, E.C.3.

Maidstone.—Showrooms, 61-3, King Street; Anstey's, Ltd., car sales service, 34, Lower Stone Street.

Newcastle-on-Tyne.—New terminal buildings at Woolsington Airport (£500,000); G. Kenyon, city architect, 18, Cloth Market.

Northumberland.—Secondary school, Seahouses (£54,000); R. Slawther, builder, Lesbury, Alnwick.

Oxford.—Primary school, Blackbird Leys estate; Fredk. J. Minns & Co., Ltd., builders, Botley Road.

Reading.—Manor Junior School, six 15-storey blocks of flats, Coley Park estate, and 46 flats, Basingstoke Road; G. F. Darlow, town clerk, Town Hall.

Scarborough.—Proposed abattoir (£74,000); H. V. Overfield, borough engineer.

Sutton (Surrey).—Reinstatement and reconstruction works at Belmont Hospital for South West Metropolitan Hospital Board (£81,150); R. Mellor, architect to Board, 76, Wimpole Street, London, W.1.

Swansea.—Assembly hall and classroom block for Technical College; borough architect.

Pasteurising plant: Cambrian United Dairies, Ltd., Hafod Isha.

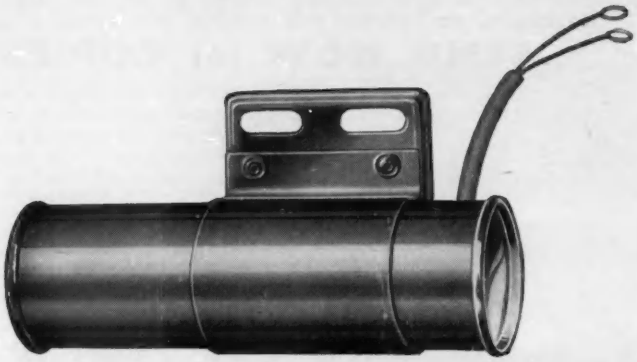
Thurso.—Houses (200); J. A. Bent, Scottish Special Housing Association, Ltd., 15/21, Palmerston Place, Edinburgh, 12.

Torquay.—Concert hall, Princess Parade; borough engineer.

Whitley Bay.—Houses (32), Millfield estate; E. Roberts, borough engineer.

Wolverhampton.—Erection of new Wulfrun College of Further Education (£300,000); borough engineer, Town Hall.

NON-STOP STARTING



Type TM3.

With this Dubilier Motor Starting Capacitor you can be sure of reliable starting every time. The capacitor element is hermetically sealed in an aluminium inner can mounted in a seamed metal outer casing with a strong mounting bracket designed to withstand a good deal of rough treatment.

Available in three ranges of r.m.s. voltages—150V: from 160 to 280μF; 275V: from 65 to 130μF; 350V: from 50 to 100μF.

Reliable operation at temperatures up to 60° C

Motor Start Capacitors by DUBILIER

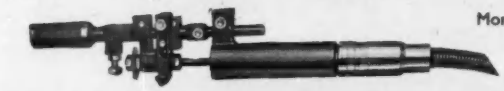
DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA RD., NORTH ACTON, LONDON, W.3. Phone: ACOrn 2241. Grams; Hilvoltcon Wesphone London.
DN 209

MARTINDALE

MICA UNDERCUTTING *System No. 2*

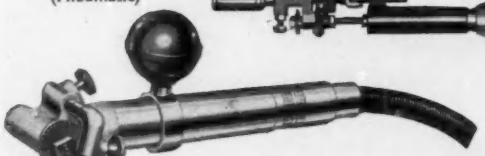
Quick, clean "U" or "V" undercutting of almost any size or type of commutator can be effected with the aid of power milling tools as illustrated.

Undercutting Saw — Undercutting "V" Cutter



Monarch Undercutter (Flex-Drive)

Monarch Undercutter (Pneumatic)



Mica Miller (Flex-Drive)

Mica Miller (Pneumatic)

With small saws or "V" cutters slots can be cut almost to the risers and only in special cases is it necessary to complete the cuts by file.

The milling heads are interchangeable with the oscillating heads of the Mica Slotters used in the Martindale System No. 1.

Mica Miller (Electric)

Write for details of other Martindale Undercutters, Fault Finders, Commstones, etc.

also at
23 Elmbank Street, Glasgow, C.2

MARTINDALE ELECTRIC CO. LTD.
4 WESTMORLAND ROAD, LONDON, N.W.9

TAKE YOUR PICK

Our wide range of capacitors, incorporating all the very latest developments, are described fully in these new leaflets . . .

SEND NOW for COPIES

DALY has succeeded in maintaining full capacity values and working voltages in more compact designs, specially suited to ultra-modern equipment:

PHOTO-FLASH EQUIPMENT • DEAF AIDS
PRIVATE TELEPHONE INSTALLATIONS
AMPLIFIERS • D.C. POWER UNITS
TRANSISTOR EQUIPMENT
MAGNETISATION EQUIPMENT
TEST GEAR

DALY
ELECTROLYTIC
CAPACITORS

Condenser Specialists for over 20 years.

DALY *(Condensers)* **LTD.,** WEST LODGE WORKS,
THE GREEN, EALING, LONDON, W.5. PHONE: EALING 3127-8-9. CABLES: DALCYON, LONDON

TO OUR NUMEROUS FRIENDS

We trust that our efforts to fulfil your requirements have met with your approbation and we take this opportunity of tendering to you

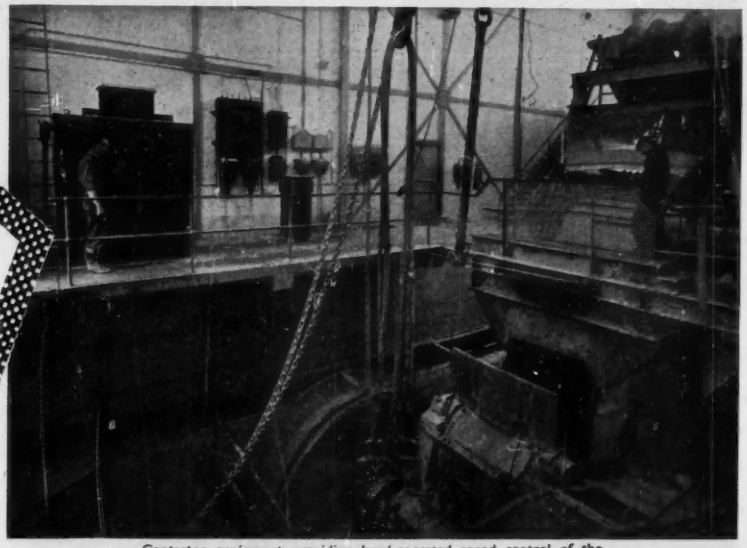
BEST WISHES FOR 1959

RICH & PATTISON (B'HAM) LTD., ELECTRICAL WHOLESALERS & MANUFACTURING ENGINEERS, JAMAICA ROW, BIRMINGHAM, 5, & FORD STREET, COVENTRY

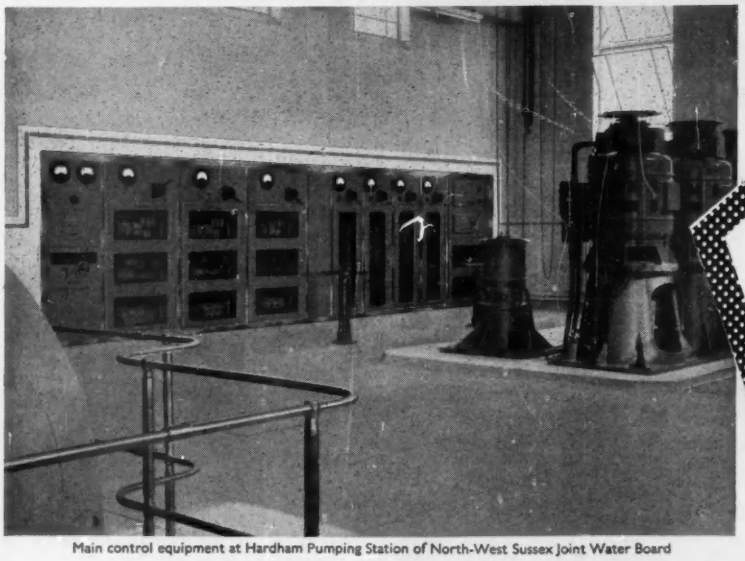
MOTOR CONTROL GEAR

for every industrial application

from the rigours of a Stone Quarry...



Contactor equipment providing hand-operated speed control of the Primary Crusher of Cornelly Quarry of The Steel Company of Wales Ltd



... to the elegance of a Pumping Station

Main control equipment at Hardham Pumping Station of North-West Sussex Joint Water Board

For every electric motor there is an Allen West starter

ALLEN WEST

ALLEN WEST & CO LTD BRIGHTON ENGLAND · Telephone: Brighton 23291 · Telegrams: Control, Brighton
Engineers and Manufacturers of Electric Motor Control Gear and Switchgear
SUBSIDIARY COMPANIES IN CANADA, SOUTH AFRICA AND RHODESIA · AGENCIES THROUGHOUT THE WORLD

Everything must be

CONTROLLED

Your temperature, your temper

(don't send up your blood pressure),

your office equipment, telephones,

tabulators, typewriters,

(perhaps the typists too . . . bless 'em).

but . . .

to control electricity

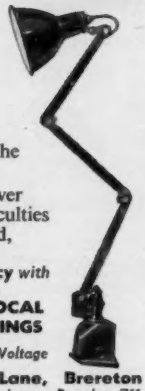
SANDERS

The mark of superiority in Switch and Fusegear.

WM. SANDERS & CO. (WEDNESBURY) LTD.
FALCON ELECTRICAL WORKS,
WEDNESBURY, STAFFS.

STAND K3
ELECTRICAL ENGINEERS' EXHIBITION
EARLS COURT
MARCH 17-21st
1959

Lighting can be tricky ....



It's a matter of getting the light on the right part of the job! Some industrial lighting problems are nearly as tricky as the one depicted above.

E.D.L. fittings have been designed with over 30 years' experience of the snags and difficulties involved. They are sturdy, easily adjusted, free from sag.

*Get **maximum** lighting **efficiency** with*

E.D.L. **INDUSTRIAL LOCAL LIGHTING FITTINGS**

for Mains or Low Voltage

THE ELECTRIC DEPÔT LTD., Redbrook Lane, Brereton RUGELEY, Staffs. Telephone: Rugeley 711

METAL RECTIFIER ENGINEERING

By E. A. Richards, M.B.E., A.C.G.I., etc. Discusses in detail the principles underlying the operations of metal rectifiers. It forms an essential book for engineers wishing to select the right type of rectifier for a particular job, and to avoid the disappointments that can ensue from incorrect working conditions. 37/6 net

RADIO RECEIVER SERVICING AND MAINTENANCE

By E. J. G. Lewis, M.Brit.I.R.E. 4th Edition. A practical manual specially written to give the radio dealer, salesman, and the service man, up-to-date and reliable assistance in the technical details of their work. A handy fault-finding summary, combined with the index, is a feature of the book. 15/- net

DIESEL PLANT OPERATORS' HANDBOOK

By A. K. L. McCrone, G.I.Mech.E. Here is a handy reference book that has been written specially for the operator of Diesel-Electric Power Plant. It gives in a concise and simplest possible form the essential facts about the equipment he uses. Theory and practice have been blended as far as possible. (Published on behalf of Blackstone & Co. Ltd.) 20/- net

From all booksellers

PITMAN TECHNICAL BOOKS

Parker St., Kingsway, London, WC2

A NEW SHAPING DRILL BY Selecta

THE drillform

WORLD PATENTS PENDING

for use with any popular Electric Drill

in WOODWORK, PLASTICS, PLYWOOD, FIBREWOOD, etc.

IDEAL FOR LOCKFITTINGS
HOLESINKING
RECESSING IN WOODWORK
JOINERY and PANELLING

RETAIL PRICE 4/3d

POST COUPON TODAY!

Please ask Representative to call ☐ *Send me details* ☐ *Tick whichever applies*

Name .....

Address .....

SELECTA POWER TOOLS LTD.
Hampton Road West, Hanworth, Feltham, Middlesex ER/D

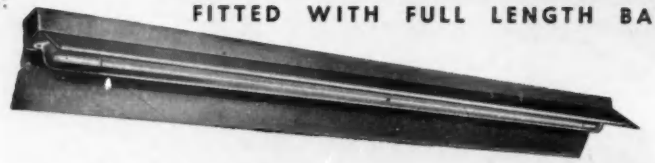
A member of the B. Elliot group of Companies

FOR BETTER LIGHTING

FLUORESCENT Wafax FITTINGS

Obtainable in 5, 4 and 2 ft. Single and Twin Models

FITTED WITH FULL LENGTH BACKPLATES



5' OPEN ENDED TROUGH
with Quick Release Covers.
£4.12.0d. List Price
excluding tube.

5' BATTEN
with Quick Release Covers.
£4.0.0d. List Price
excluding tube.

SEND FOR CATALOGUE

WADES (HALIFAX) LTD. *Arden Works, Fenton Road, Halifax* TEL. 61637

G. A. RIX

KEIGHLEY • ENGLAND

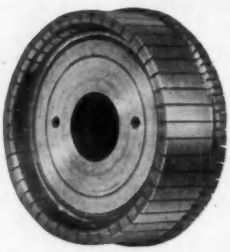
Telephone:
2420

Telegrams:
Rix, Keighley

COMMUTATORS

Commutators of all sizes, built to Manufacturers' specifications in large or small quantities.

Other Specialities include
Rebuilding large commutators
Rewinds • Coils
Armatures



for
Motors, Generators and Auto-Electrical Equipment

For Every Gauge

IN EVERY WIRING INSTALLATION

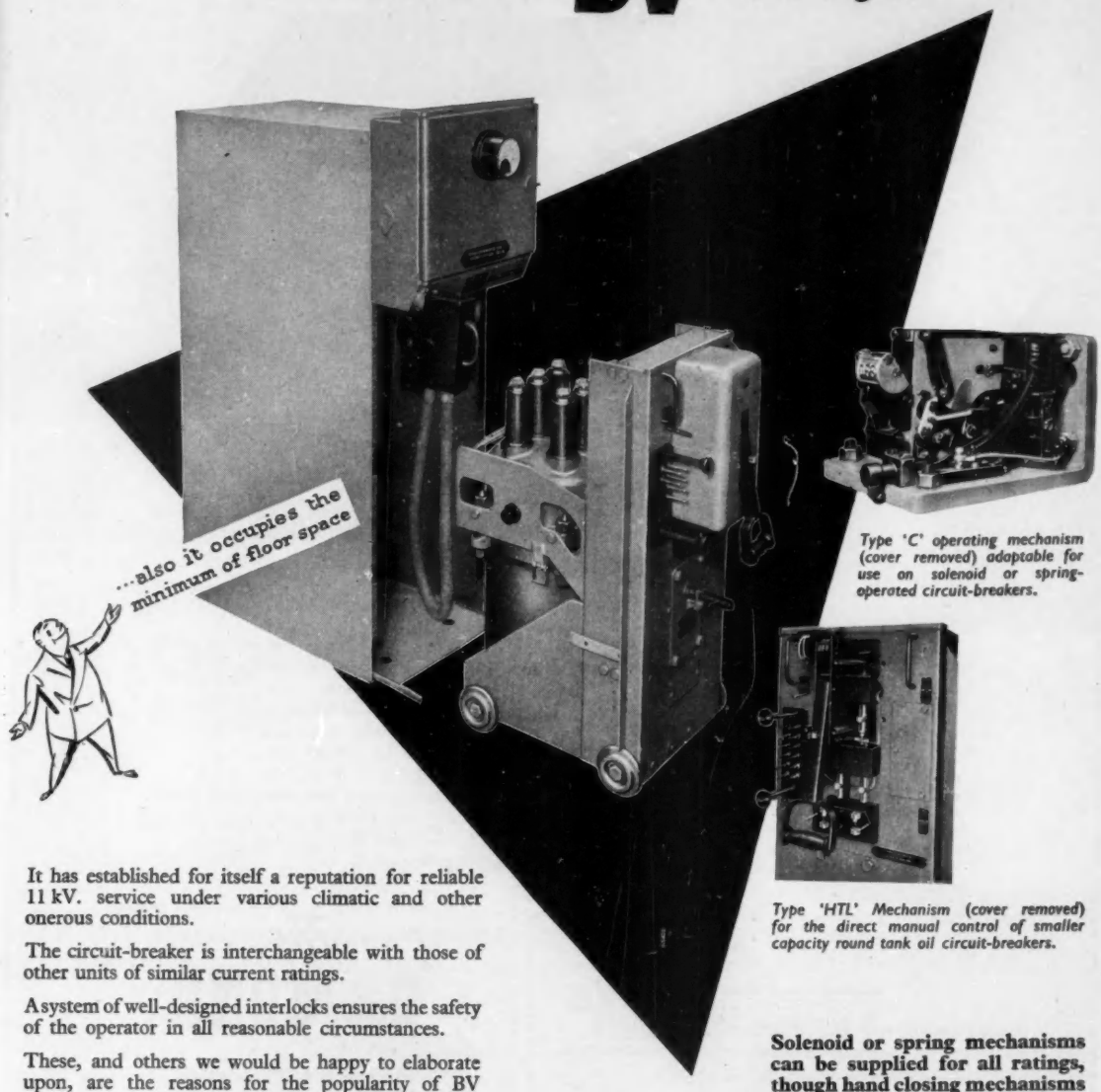
SCRUIT REGISTERED TRADE MARK

BRITISH MADE, ONE PIECE PORCELAIN CONNECTORS

MADE BY V.G. PORCELAIN CO. LTD.
GORST RD., PARK ROYAL, LONDON, N.W.10. *Telephone:* ELGAR 7362

Distributors : S. O. Bowker Ltd., Gee (Birmingham) Ltd., Birmingham, and Metway Ltd., Brighton

Reasons for the popularity of air insulated **BV** Switchgear



Type 'C' operating mechanism (cover removed) adaptable for use on solenoid or spring-operated circuit-breakers.

Type 'HTL' Mechanism (cover removed) for the direct manual control of smaller capacity round tank oil circuit-breakers.

It has established for itself a reputation for reliable 11 kV. service under various climatic and other onerous conditions.

The circuit-breaker is interchangeable with those of other units of similar current ratings.

A system of well-designed interlocks ensures the safety of the operator in all reasonable circumstances.

These, and others we would be happy to elaborate upon, are the reasons for the popularity of BV Switchgear, which may be found in service in all parts of the World.

Solenoid or spring mechanisms can be supplied for all ratings, though hand closing mechanisms are normally supplied up to a rating of 150 MVA.

NORMAL APPLICATION: Up to **800 A, 11 kV, 75/250 MVA** **SINGLE BUSBAR SYSTEMS**

Ferguson Pailin LIMITED *for Switchgear*

An A.E.I. Company

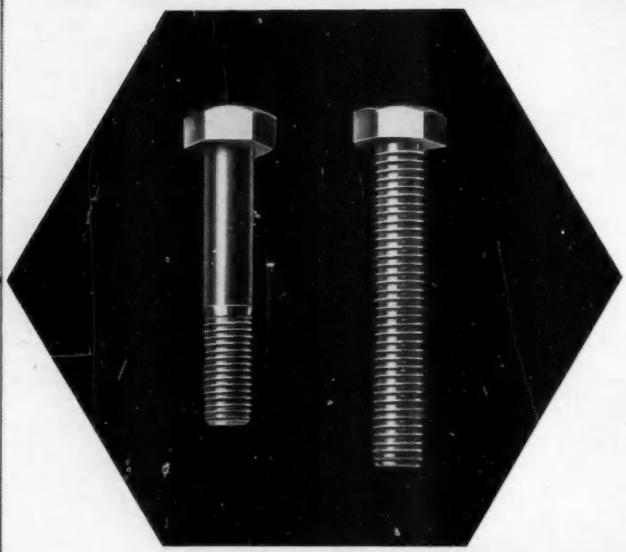
Head Office & Works: **HR. OPENSHAW MANCHESTER 11,** *Telephone :* DROylsden 1301 (Pte.Branch Ex)

LONDON OFFICE: 33 Grosvenor Place, S.W.1 BIRMINGHAM OFFICE: Windsor House, 656 Chester Road, Erdington, 23 GLASGOW OFFICE: Central Chambers, 109 Hope Street, C.2

REPRESENTED IN PROVINCIAL OVERSEAS TERRITORIES

COLD HEADED BOLTS & SETSCREWS

R



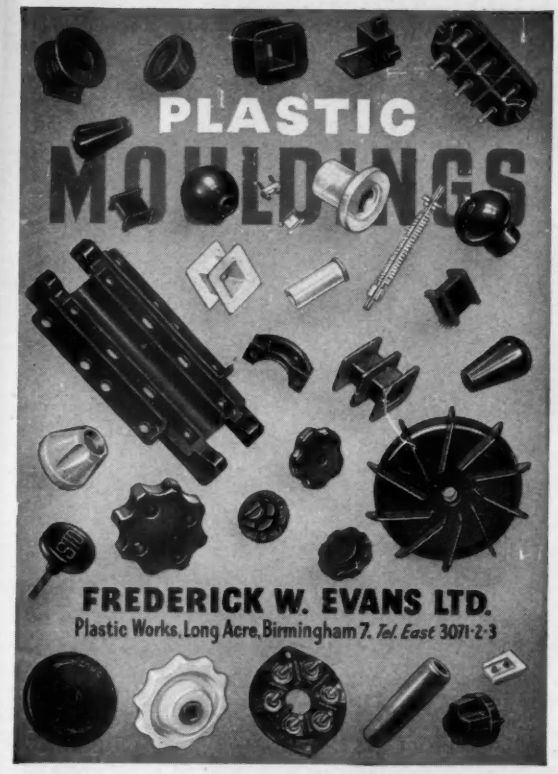
Why look elsewhere, when all the benefits of long specialization plus the closest adherence to exacting quality standards are so conveniently available. Let ORMOND quote for *all* Repetition Parts—for Multifactors, Variomatics, single and multi spindle automatics up to 1¼" diameter; Brass, Steel and Light Alloy Screws in Rolled and Cut Threads, Grubscrews, Nuts, All Threads, Hexagon Bolts and Setscrews turned from bar and Cold Headed Grades "A", "B", and High Tensile and Socket Cap Screws.

ENGINEERING ORMOND COMPANY LTD.

The
ORMOND
Engineering
Co. Ltd.

Ormond House
Rosebery Avenue
London, E.C.1

Telephone : TERminus 2888
Telegrams : "Ormondengi, Smith"



TESTED TO
20,000,000
OPERATIONS

—that's *one* reason for choosing BROOKHIRST Snap Action Limit Switches—well-proved reliability. Other reasons: positive quick make and break changeover contacts, consistently accurate tripping, robust splash-proof or watertight enclosure.

For full information write for Leaflet 2103

BROOKHIRST | SNAP ACTION LIMIT SWITCHES

BROOKHIRST SWITCHGEAR LTD., CHESTER
A METAL INDUSTRIES GROUP COMPANY CVS-62

There is a suitable gauge and mesh—

FOR EVERY INDUSTRIAL PROCESS

'Harco' Woven Wire

For screening, sorting or sifting heavy minerals or fine powders.

For filtering and processing liquids and semi-solids.

For restricting access and providing protection.

For improving presentation, the ornamental patterns add style and dignity to industrial design.

Please ask for Catalogue No. EL858

Harvey

G. A. HARVEY & CO. (LONDON) LTD.
Woolwich Road, London, S.E.7 · GREenwich 3232 (22 lines)

QUICKWAY

MDC LTD

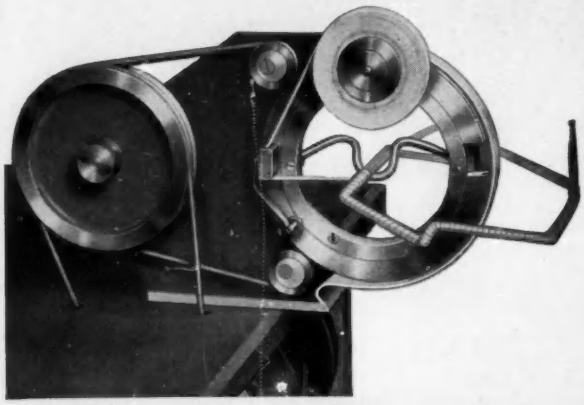
Taping machines
SPEEDY
taping for all type coils

Tapes stator and armature coils quickly and neatly. Other applications are the taping of busbars, wiring harnesses, etc.

A necessity for repairs or production, and an ideal companion to a "QUICKWAY" Coilwinding and Forming Machine.

We can offer individual items with the machine such as clutch unit and motor, or a complete arrangement with bench.

Full details on request.



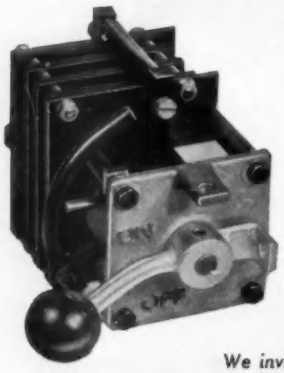
THE MIDLAND DYNAMO CO. LTD.

QUICKWAY WORKS - LEICESTER - Tel. 20172 (5 lines) Grams: "DYNAMO" LEICESTER

"Colne"

ISOLATOR SWITCHES

660 v. 60 ampere capacity A.C. with door interlock mechanism.



We invite your enquiries

Manufactured by

Colne

SWITCHGEAR (K & W) LTD.

formerly Electrical Products (Colne) Ltd.

Walton Street, Colne, Lancs.

Phone: Colne 1394/5

for Electrical Insulation

VULCANISED FIBRE

LEATHEROID

EBONITE

BAKELITE (*Fabric & Paper Base*)

of every type

The largest and most comprehensive range of insulating materials in the country. Supplied in sheet, rod and tube form

Strip and coil form material cut accurately to size for stamped components, can be offered at very competitive prices and deliveries. Samples on application.

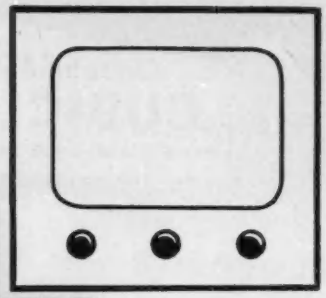
Also **Turned and Pressed Parts**

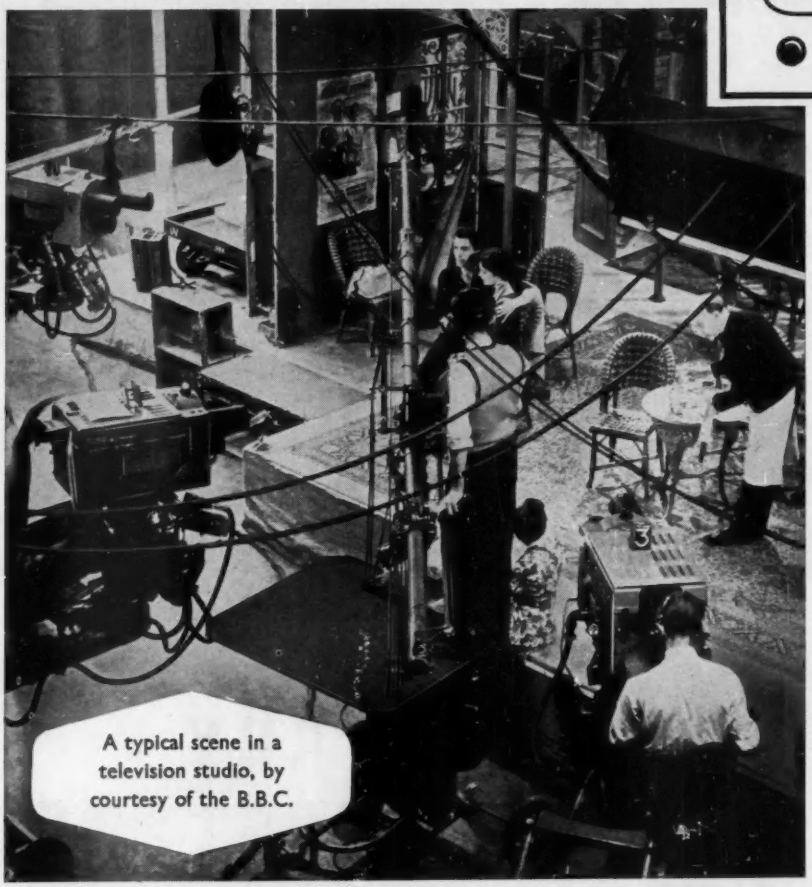
HEAVEN, DOWSETT & Co Ltd.

INSULATION HOUSE, 315 WELLINGTON ROAD BIRMINGHAM 20

Phone: BIRchfield 6218-9 *Grams:* Fibre B'ham 20

Cables used for your entertainment..





A typical scene in a television studio, by courtesy of the B.B.C.

In a television studio there are cables all over the place.
Your programme depends on these cables being reliable.
We have supplied the B.B.C. and manufacturers with cables for every purpose.
Let reliability decide your choice of cables.

Our range includes –

Aluminium Overhead Cables
"CORRUSTEEL" Armoured Cables
"WANDOVERPLAS" Overhead Cables
"FLORAWARM" Floor Heating Wires and Cables
"IRRAYDOL" Irradiated Cables
and a full range of all Domestic Wires and Cables

WANDLESIDE CABLES ***for every purpose***

WANDLESIDE CABLE WORKS LTD. 106 GARRATT LANE WANDSWORTH LONDON S.W.18

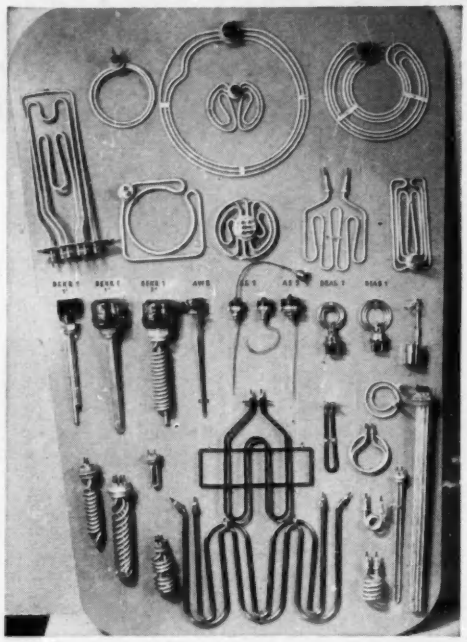
One of FALKS Group

Telephone: VANdyke 7544 (5 lines) Telegrams: Wandleside, London

Custom Built
CUBICLES
PANELS AND SWITCHBOARDS

also
COXAUTO
AUTOMATIC VOLTAGE REGULATORS
for
FLUCTUATING A.C. SYSTEMS

Est. 1880
COX-WALKERS *Ltd.*
NORTH EASTERN ELECTRIC WORKS
DARLINGTON Telephone 2387



ELTRON for ELEMENTS
AIR, OIL or WATER
ELTRON (LONDON) LTD., STRATHMORE RD., CROYDON
THORNTON HEATH 1861
E.R.5

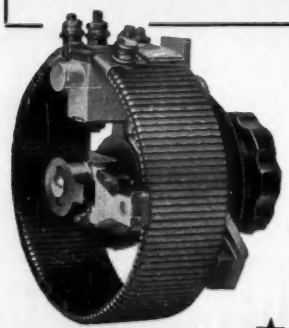
Are you satisfied with the Quality, Price and Service of the Silver Plating on your Electrical Contacts

FULLY APPROVED A.I.D.-A.R.B.
ALL FINISHES

N.T. FROST LTD.
SPECIALIST ELECTROPLATERS
HARFORD ST., BIRMINGHAM 19
CENtral 4135 (6 Lines)

a range of extremely robust

ROTARY RHEOSTATS



Open or enclosed types
100 watts
150 watts
200 watts
Larger sizes quoted on request

An extremely robust rheostat with a unique metal cored former (patent appd. for)

Full details from the manufacturers

The **CURTIS** *Manufacturing Company Limited*
26-28 PADDENSWICK ROAD
HAMMERSMITH, W.6
Telephone: RIV. 4456 and 4583

A range of sizes from 1" to 4" dia.

KNOBS and HANDWHEELS

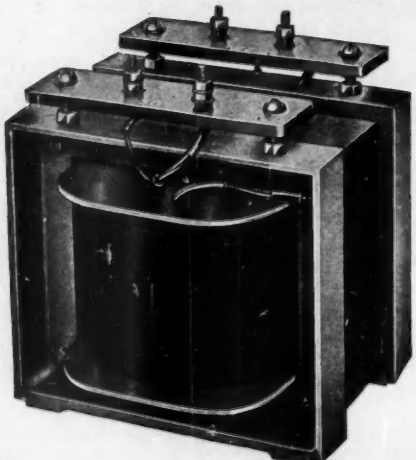
Supplied with many different threaded or plain male or female inserts and in a full range of colours

Litholite Plastic Mouldings since 1901

LITHOLITE Insulators & St. Albans MOULDINGS LTD.
Sandown Road, WATFORD, Herts. Tel. WATFORD 23377

Insist on T.E.C.

POWER AND DISTRIBUTION TRANSFORMERS TO 100 kVA, LOW VOLTAGE, FLASH TEST AND RECTIFIER UNITS, METAL WORK, LIGHT ASSEMBLY, SLOTTED ANGLES AND TRANSFORMER & ELECTRICAL REPAIRS



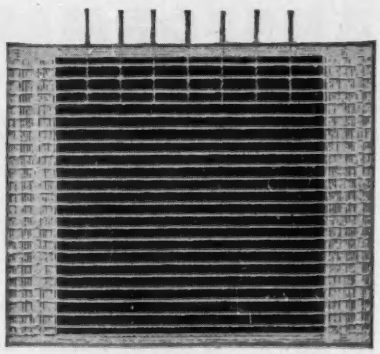
Leaflets on request:—

SINGLE PHASE AIR COOLED 'C' TYPE TRANSFORMERS 350 V.A. to 2 K.V.A.

The TRANSFORMER & ELECTRICAL CO. LTD.
HONYWOOD RD., BASILDON, ESSEX
Telephone: Basildon 20491/3

Can you say Woven Asbestos resistances ensure safe, sure service six times, quickly?

It's a mouthful, but fortunately you only have to say it once — preceded, of course, by the name CRESSALL. CRESSALL Asbestos Woven Resistance Nets are light, flat, rigid, vibration and shock proof and require only the simplest of supports for making up into banks.



It is now 45 years since we introduced Asbestos Woven Resistance Grids into this country, and the consequent steadily increasing demand is sufficient proof of the wide field in which this type of resistance unit is pre-eminent.

Write for Catalogue Section A, List 91.

Cressall
THE CRESSALL MANUFACTURING COMPANY LIMITED
(A subsidiary of The Expanded Metal Co. Ltd.)

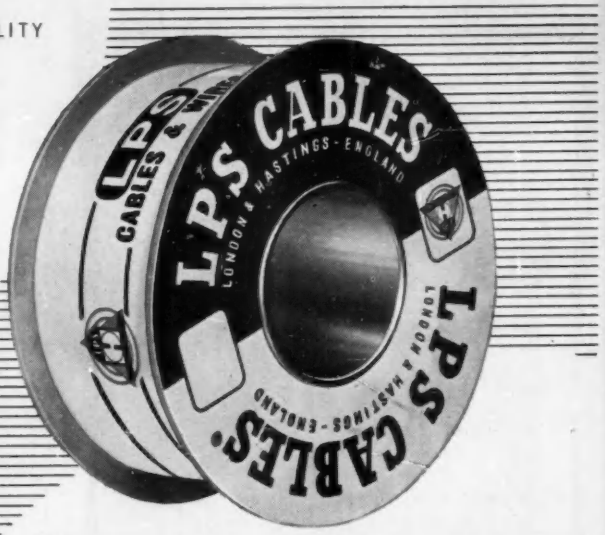
A.I.D. & A.R.B. APPROVED

ECLIPSE WORKS · TOWER STREET · BIRMINGHAM 19 · TEL: ASTON CROSS 2068
LONDON OFFICE: BURWOOD HOUSE · CAXTON STREET · S.W.1 · TEL: ABBEY 7766

THE SYMBOL OF QUALITY

LPS

INSULATED
WIRES & CABLES



Quality Cables

Manufactured and tested in strict accordance with—
B.S.S. 1557—Polythene Insulated and P.V.C. sheathed cables and Armoured Cables.
B.S.S. 2004—P.V.C. insulated only, and sheathed and armoured cables.
B.S.S. 7—Rubber Cables and flexibles.

L.P.S. ELECTRICAL CO. LTD.

122 DRURY LANE, LONDON, W.C.2

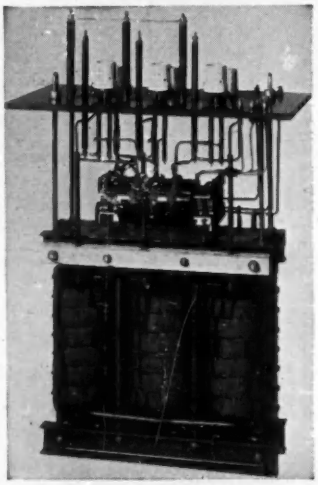
Telephone: COVent Garden 3231 (8 lines) **Grams: Engineyor, Phone, London** **Works: St. Leonards-on-Sea—Hastings 7061**

TRANSFORMERS

FOR DISTRIBUTION AND INDUSTRY

Rectification for D.C. equipment · Testing units (1 or 3 ph.) with multiple tapping switch · Isolating transformers for electrical tools · Transformers for electronic equipment up to 30 kV · All industrial requirements up to 250 kVA.

Our transformers comply with all relevant B.S. specifications.



25 kVA rectifier unit for 12,000 v. D.C.

S.T.L. *Transformers are widely used in industry. where reliable units are required for continuous duty.*

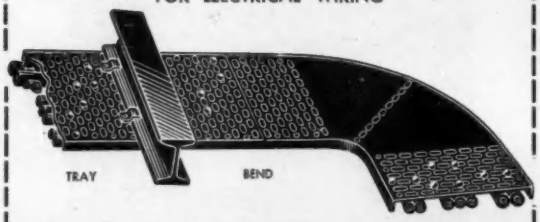
STEWART TRANSFORMERS LTD.
Kilburn Lane London W.10 Tel. LADbroke 2296/7

PERFORATED METALS

FOR ALL ELECTRICAL REQUIREMENTS

Perforated Lead for Batteries

CABLES—TRAYS and BENDS
FOR ELECTRICAL WIRING



W. BARNS & SON
(HOLLOWAY) LTD.

Successors to W. BARNS & SON — Established 1860

GLOBE WORKS, QUEENSLAND ROAD
HOLLOWAY, LONDON, N.7

Telephone: NORTH 3347/8

Telegrams: "PERFORATION, HOLWAY, LONDON"

JM
JOHN MORRIS
ELECTRICAL ENGINEERING CO. LTD.
BILSTON TEL. 41237-8 STAFFS

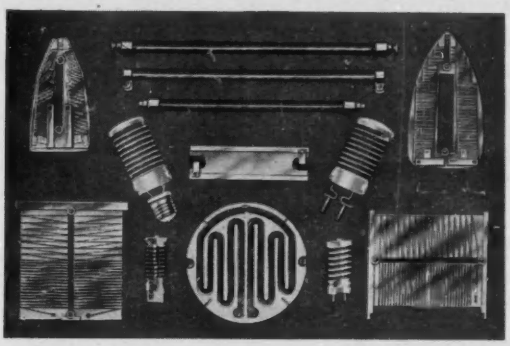
CONTROL RELAYS

Type CR

Available as:— AC/DC Direct Acting or Time Delayed Models with up to five normally open and five normally closed contacts.

Ask for leaflet CR150453

dependable
ELEMENTS
for every job
Stocked by Leading Wholesalers



THE
ELECTRIC ELEMENTS CO.
Tokenhouse Yard, NOTTINGHAM
Makers of Elements since 1921

INSULATED WIRES AND STRIPS

REGD
STANDS FOR
THE BEST

F. D. SIMS LIMITED
P.O. BOX 8, Hazelhurst Works
RAMSBOTTOM - Manchester
Telephone: Ramsbottom 2213/4/5
Telegrams: "SIMS" Ramsbottom
London Office and Stores:
106 Newlands Park, Sydenham, London, S.E.26
Telephone: SYDenham 4211/2

543

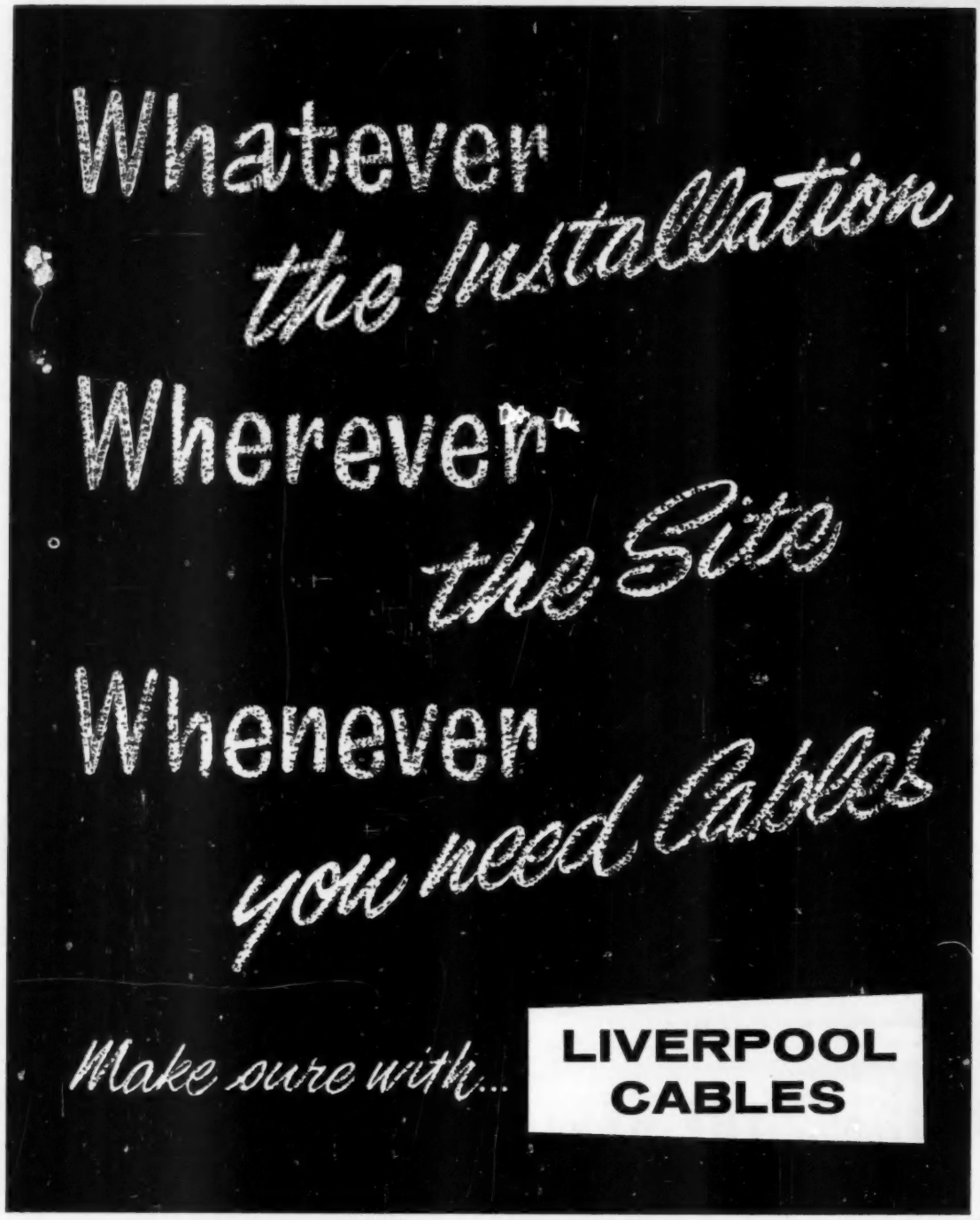
R
INSULATING BEADS
Resistance Wires
& Co. Ltd.

7 Springfield Street Warrington
Warrington 34391/2

102 Abbey Street Accrington
Accrington 2774

161/163 Eldon Street Preston
Preston 57975/6

Lionel Robinson
& Co. Ltd.
4 Staple Inn
London, W.C.1
Telephone - - HOLborn 6322



THE LIVERPOOL ELECTRIC CABLE COMPANY LIMITED

LINACRE LANE · BOOTLE · LIVERPOOL 20

Certification Mark

Regional Guide to

ELECTRICAL CONTRACTORS

LONDON

Industrial, Commercial and Housing Installations
Factory Maintenance. Motor Rewinds
EDWARDS, WYATT & COURT (Installations) LTD.
70/72 Whitwell Road, E.13
Telephone: ALBert Dock 5295/6/7

J. G. SNEATH LTD.
Wallwood Street, Limehouse, E.14
Telephone: EASt 2428-9
Rewinds and Repairs. Industrial Installations

Motor and Generator Repairs and Rewinds, Lighting and Power Installations. Factory Maintenance Contracts.
COLLINS ELECTRICAL LTD.
115 Clerkenwell Road, E.C.1
Telephone: HOLborn 0212-3-4 & CANonbury 3227-8

Lighting, Heating and Power Installations. Factory Maintenance and Motor Stockists
C. J. FERGUSON & SONS LTD.
33 Barbican, London, E.C.1
Telephone: MONarch 5474-5

Industrial Installations. Power, Heating and Lighting. Factory Maintenance. Electrical Engineers. Break-down Specialists
F. A. ORRICK & CO. LTD.
157 Camberwell Road, S.E.5
Telephone: RODney 5548

BARLOW & YOUNG LTD.
55 Catherine Place, Westminster, S.W.1
Telephone: VICtoria 7373
Installations of all Types

BERKELEY ELECTRICAL ENG. CO. LTD.
Vincent House, Vincent Square, S.W.1
Telephone: VICtoria 8051
Electrical Engineers and Contractors

H. J. CASH & CO. LTD.
Caxton House, Tothill Street, S.W.1
Telephone: WHItehall 4774
Electrical Engineers and Contractors

DRAKE & GORHAM (Contractors) LTD.
36 Grosvenor Gardens, Westminster, S.W.1
Telephone: SLOane 0121
Electrical Engineers and Contractors

EDMUNDSONS CONSTRUCTION CO. LTD.
Electrical Engineers and Contractors
24-30 Gillingham Street, S.W.1
Telephone: VICtoria 1713

One of the Largest Electrical Contractors in the Industry
ELECTRICAL INSTALLATIONS LTD.
65 Vincent Square, Westminster, S.W.1
Telephone: VICtoria 2266 (10 lines)

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
39 Victoria Street, S.W.1
Telephone: ABBey 8080 (8 lines)

TROUGHTON & YOUNG LTD.
2 Basil Street, London, S.W.3
Telephone: Kensington 3444
Electrical Engineers and Contractors

BURDETTE & CO. LTD.
150 Clapham Manor Street, S.W.4
Telephone: MACaulay 4555
Industrial Installations. Motor and Generator Repairs. Metallizing Treatments. Complete Electrical Maintenance. Heating and Ventilating.

WILSON ELECTRIC (BATTERSEA) LTD.
122a, Clapham Manor Street, S.W.4
Telephone: MAC 6768 & 3737
Electrical Engineers and Contractors. Motor Rewinds and Repairs. Installations. " Delco " Electric Motors—Approved Stockists and Repairers.

Industrial Installations throughout the Country. Power, Maintenance and Insurance
CITY ELECTRICAL CO.
Emerald Street, W.C.1 *Telephone: HOL. 9722 (6 lines)*
Repairs and Rewinds—Motor Stockists

A. TINDALL & SONS
22 Rosemary Avenue, Enfield
Electrical Engineers and Contractors
Telephone: ENField 6612 (3 lines)

F. W. BLANSHARD LTD.
23 Lansdowne Road, Purley, Surrey
Telephone: Uplands 4818, 4819 & 4810
Complete electrical installations. Rewinding and repair of motors and transformers. Manufacturers of control gear for fluorescent.

SERVICE ELECTRIC CO. LTD.
Secomak Works, Honeypot Lane, Stanmore, Middx.
Telephone: EDGware 5566-7-8-9
Electrical Installations of every kind. Motor Rewinds. Factory Maintenance

DYNAMO & MOTOR REPAIRS LTD.
North End Road, Wembley Park
Telephone: Wembley 3121
Motor and generator repairs and rewinds. Installations and factory maintenance. Electrical plant stockists

SOUTH EASTERN

GALLIERS
32 St. James's Street, Brighton
Telephone: Brighton 23201-2-3
Farm and Dairy Electrical Equipment

Electrical, Refrigeration and Radio Engineers. Installation Contractors. Lifts. Television
H. BENEY & SONS LTD.
99 South Street, Eastbourne
Telephones 4820/1 (Day and Night)

For first-class A.C. and D.C. Rewinds and Industrial Plant Maintenance
ELECTRICAL POWER REPAIRS (Gillingham) LTD.
Strover Street, Gillingham, Kent
Telephone: Gill. 5200 & 59356 (Day and Night)

Heavy Engineering and Electrical Contracting
DRAKE & FLETCHER LTD.
Maidstone, Kent
Telephone 2284
Refrigeration. Oil Heating and Drying Installations

F. W. BLANSHARD LTD.
23 Lansdowne Road, Purley, Surrey
Telephone: Uplands 4818, 4819 & 4810
Complete electrical installations. Rewinding and repair of motors and transformers. Manufacturers of control gear for fluorescent.

SOUTHERN

GOATER & MEDWAY LTD.
Electrical Engineers
121 Commercial Road, Southampton
Telephone 21440
Cable Jointing. Cable Laying. By Direct Contract and to the Trade.

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
32 Brassey Road, Winton, Bournemouth
Telephone: Winton 1609

. . . for all electrical installations
F. H. WHEELER (Southern) LTD.
Clifton Hall, Oakley Road, Shirley, Southampton
Telephone 73867

SOUTH WESTERN

. . . for all electrical installations
F. H. WHEELER (Bristol) LTD.
55 Queen Charlotte Street, Bristol 1
Telephone 26907

CLARKE BROS. (Stroud) LTD.
Bath Road, Stroud
Telephone: Stroud 1132/3
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

TEESDALE & JONES LTD.
27-28 Fleet Street, Swindon
Telephone: Swindon 2025 & 2110
Electrical Installation Contractors
Established 40 years

EASTERN

Norwich.....Cambridge.....Gt. Yarmouth.....Lowestoft.....Ipswich
EASTERN & HOME COUNTIES ELECTRICAL CONTRACTORS
Specialists in Large Scale Electrical Installation Contracts.
Electra House, Southtown Road, Gt. Yarmouth
Telephone: Gt. Yarm. 2390

(Continued on page 60)

(Continued from page 59)

EAST MIDLANDS

Electrical Engineers and Contractors
C. A. J. BILLINGTON LTD.
Cranfield, Bedfordshire
Telephone: Cranfield 293
Industrial Installation throughout the Home Counties

MIDLANDS

WALKER BROS. (ELECTRICAL ENGINEERS) LTD.
Quality House, Temple Row, Birmingham 2
Telephone: CEN. 7611/5
Electrical Installation Engineers. Industrial Installation Specialists
Established 1895

HARRIS & SHELDON LTD.
31 Stafford Street, Birmingham 4
Telephone: Central 7101
For all electrical contracting installations, lighting, heating, power, public address, etc.

Electrical and Mechanical Engineers, Factors
THE BIRMINGHAM POWER TRANSMISSIONS LTD.
117/118 Snow Hill, Birmingham 4
Telephone: AST. 2088-9

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
553 Moseley Road, Birmingham 12
Telephone: Calthorpe 2601-2

DYNAMO & MOTOR REPAIRS LTD.
Belgrave Terrace, Soho Road, Birmingham 21
Telephone: Northern 0898
Motor and generator repairs and rewinds. Installations and factory maintenance. Electrical plant stockists

For Electrical Installations of Quality consult:
HAROLD F. WARD LIMITED
Birmingham 28
Telephone: VIC 4041 (5 lines)

ELECTRICAL INSTALLATIONS LTD.
Faraday Works, Stoney Stanton Road, Coventry
Telephone 2970
Industrial Electrical Work of All Kinds. Over 40 Years' Experience

G. G. WALKER & CO. (Dudley) LTD.
31 Hall Street, Dudley
Telephone 4474/5
Rewinds, Lighting, Power, Electric Furnace, Electronic Installations and Maintenance. Television and Radio. Est. 40 years. E.C.A. Members

SOUTH WALES

CLARKE BROS. (Stroud) LTD.
Green Park Street, Aberavon
Telephone: Port Talbot 791
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

DRAKE & GORHAM (Contractors) LTD.
13 St. Andrew's Crescent, Cardiff
Telephone: Cardiff 32080
Electrical Engineers and Contractors

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
117 Woodville Road, Cardiff
Telephone 21281-2 *Telegrams: "Whelect"*

CLARKE BROS. (Stroud) LTD.
High Street, Merthyr Tydfil
Telephone: Merthyr Tydfil 377
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

MERSEYSIDE & N. WALES

TROUGHTON & YOUNG LTD.
46 Rodney Street, Liverpool 1
Telephone: Royal 9231-2
Electrical Engineers and Contractors

H. J. CASH & CO. LTD.
28 Chapel Street, Liverpool 3
Telephone: Central 0452
Electrical Engineers and Contractors

YORKSHIRE

Electrical Engineers and Contractors
SOUTHERN & REDFERN LTD.
Woodhead Road, Bradford 7
Textile Maintenance, Repairs and Rewinds
Telephones: Bradford 23871—Late Phone: Bradford 65837

EDMUNDSONS CONSTRUCTION CO. LTD.
Electrical Engineers and Contractors
2 Hartley Hill, Leeds 2
Telephone: Leeds 33791

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
44 Bank Street, Sheffield 1
Telephone 24015 (3 lines) *Telegrams: "Whelect"*

NORTH WESTERN

H. J. CASH & CO. LTD.
28 Chapel Street, Liverpool 3
Telephone: Central 0452
Electrical Engineers and Contractors

STEWART THOMSON & SONS (Liverpool) LTD.
Fort Road, Seaforth, Liverpool 21
Repairs and Rewinds A.C. and D.C. to 3,000 horsepower. Breakdowns, Urgent Repairs, etc. 24-hour service
Telephone: Bootle 2697-8

DRAKE & GORHAM (Contractors) LTD.
21 Newton Street, Piccadilly, Manchester 1
Telephone: Manchester Central 4701
Electrical Engineers and Contractors

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
Regal Buildings, Oxford Road, Manchester 1
Telephone: Central 8207-8

Industrial Installations
W. H. SMITH & CO. ELECTRICAL ENGINEERS LTD.
12 York Street, Manchester 2
Telephone: CENtral 2991-6
Works: Praed Road, Trafford Park, Manchester 17

THE NELSON ENGINEERING CO. LTD.
Telephone: Nelson 1545/6
Electrical and Mechanical Engineers.
Complete Industrial Installations. Rewinds
Netherfield Road, Nelson

EDWARD DEWHURST LIMITED
Mount Street Works, Preston
Telephone : Preston 3281
Electrical and Mechanical Engineers, Complete Industrial Installations, Rewinds, Factory Maintenance, Special Switchboards, etc.

NORTH EASTERN

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
52 Elswick Road, Newcastle
Telephone: Newcastle 36271

Applications for particulars of costs and standard style of advertisements in this Regional Guide should be addressed to :

THE

ADVERTISEMENT DEPARTMENT,

ELECTRICAL REVIEW,

DORSET HOUSE, STAMFORD STREET,

LONDON, S.E.1

INSTRUMENT WIRES

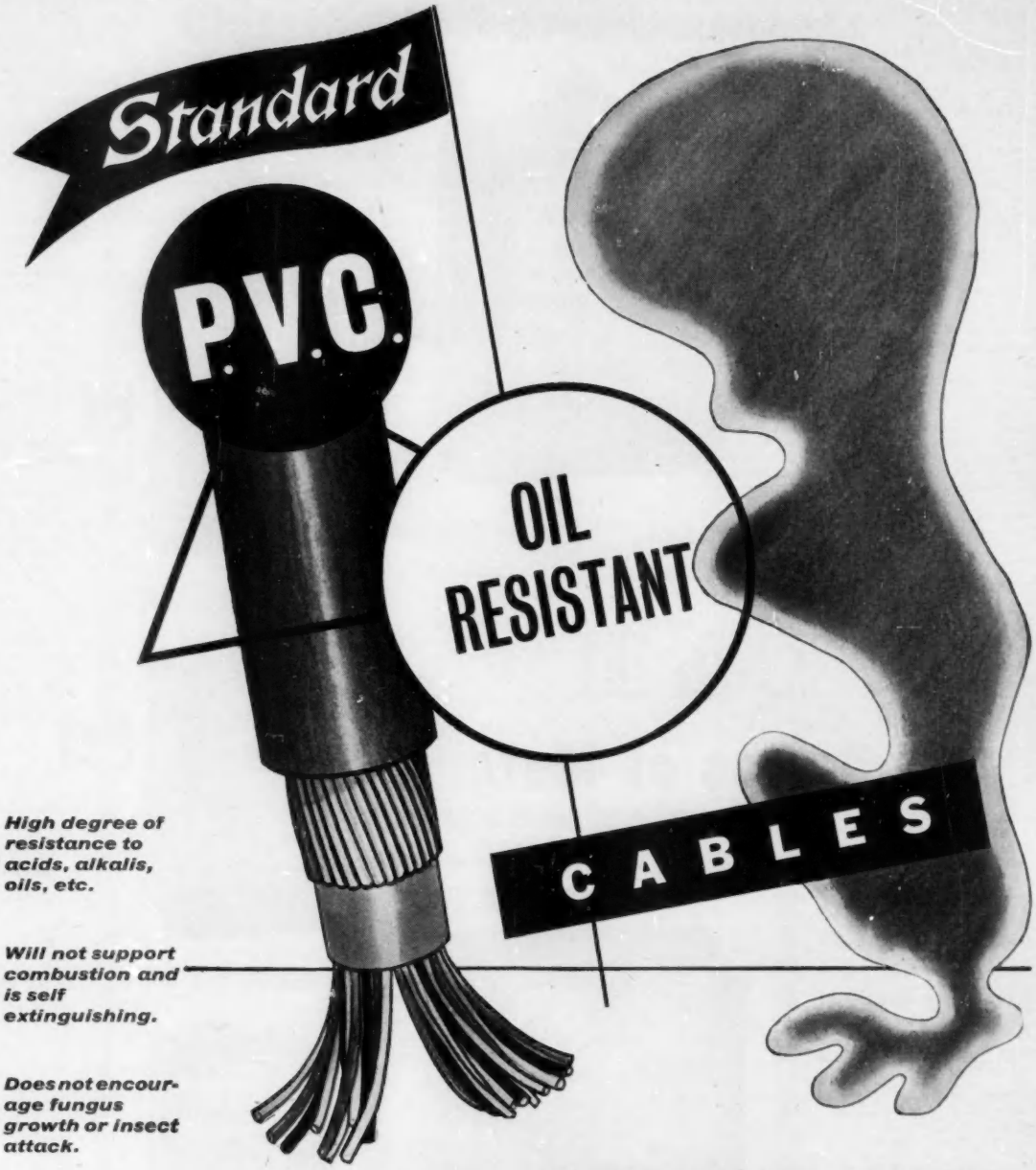
AND INSULATING MATERIALS

ENAMELLED, SILK and COTTON covered Copper Wires, Single or Stranded, also Tinned, Paper, Asbestos and Plastic Westoflex covered. RESISTANCE WIRES. LITZ WIRES.

MICA, MICANITE and BAKELITE in all forms. Heat Resisting Boards. Canvasite for Silent Gears. Oil Cloth, Silk and Paper. Slot Insulations. Insulating Varnishes. Varnished Fabric and Plastic Sleeving. Moulded and Machined Pieces, etc.

WEST INSULATING COMPANY LTD.

2 Abbey Orchard Street, Westminster, S.W.1. Telephone: Abbey 2814 and 7352



- *High degree of resistance to acids, alkalis, oils, etc.*
- *Will not support combustion and is self extinguishing.*
- *Does not encourage fungus growth or insect attack.*
- *Greater dielectric strength at normal temperatures.*

for the Petroleum Industry

P.V.C. insulated and sheathed cables manufactured by S.T.C. represent a notable advance in cable design. They are light and easy to handle and the distinctive bright colours are of great assistance to installation and maintenance engineers.

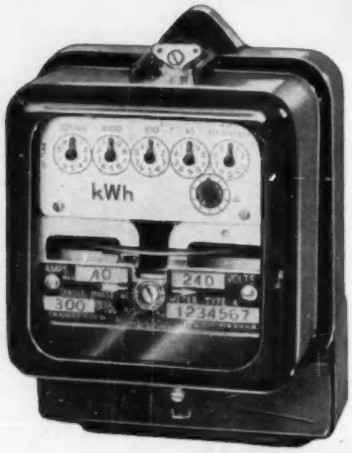
P.V.C. offers many advantages over conventional types of insulation some of which are shown alongside.

Standard Telephones and Cables Limited

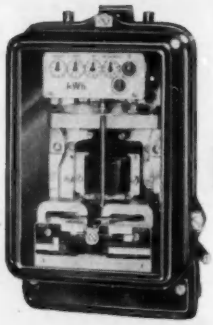
Registered Office: Connaught House, Aldwych, London, W.C.2

48, NORTH ROW, PARK LANE, LONDON, W.1

REPRESENTATIVES AND WAREHOUSES: Birmingham, Bristol, Dublin, Glasgow, London, Leeds, Liverpool, Manchester, Newcastle, Newport Nottingham, Sheffield, Southampton, Swansea, Belfast (A. W. Gordon, Ltd., Agent).



TYPE K
SINGLE PHASE



TYPE KT
3 PHASE
3 WIRE

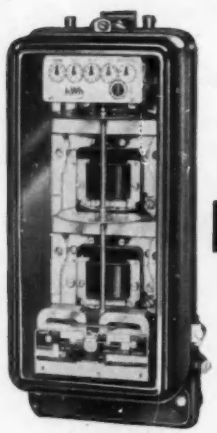
C & H

"K" Series of Meters

TYPE KTAC
3 PHASE
3 WIRE,
PRECISION
PATTERN
WITH
"FLICK"
CONTACTOR

Please apply to us for appropriate Catalogue Sections covering this "K" series of meters

TYPE KP
SINGLE PHASE—
PREPAYMENT PATTERN



TYPE KT4
3 PHASE
4 WIRE

Chamberlain & Hookham Ltd.

SOLAR WORKS, BIRMINGHAM 5. TELEPHONE: MIDLAND 0661 & 0662

London Office: MAGNET HOUSE, KINGSWAY, W.C.2. TELEPHONE: TEMPLE BAR 9000

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Advertisements are accepted up to first post on Monday of the week of issue

If displayed with boxed rules, name or symbol block by Friday prior to week of issue

All communications to be addressed to: Classified Advertisement Department, ELECTRICAL REVIEW Dorset House, Stamford Street London, S.E.1

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

COUNTY BOROUGH OF SOUTHEND-ON-SEA

Proposed Electrical Installation at Hamstel Road Primary School

THE Council invite applications from Electrical Contractors to tender for the performance of works in connection with the proposed Electrical Installation to be carried out in M.I.C.C. cable at Hamstel Road Primary School.

Such applications must be received by the Borough Architect, 30, Alexandra Street, Southend-on-Sea, by 10 a.m. on Friday, 16th January, 1959, together with details of similar works previously undertaken and names of architects or local authorities from whom references may be obtained. From such applications a selected list of tenderers will be made, and those selected will be notified and will be required to make a payment of a deposit of £2.

After receipt of this deposit the drawings, specification and form of tender will be forwarded, and it is anticipated that these will be available in mid February, 1959. The deposit of £2 will be refunded on receipt of a bona fide tender or the return of all loaned documents.

The Corporation do not bind themselves to accept the lowest or any tender.

ARCHIBALD GLEN,
Town Clerk. 5875

ENFIELD CIVIC CENTRE
(Contract No. 1)

APPLICATIONS are invited from contractors for permission to tender for the Mechanical and Electrical Services Sub-Contract in connection with the erection of a new Civic Centre at Enfield.

The closing date for the receipt of tenders will be notified when the documents are dispatched.

The lowest or any tender will not necessarily be accepted, nor will the contractors receive any payment for fees or expenses incurred in the preparation of tenders.

Applications should be made to Harding, McDermott & Partners, Consulting Engineers, 17, Doughty Street, London, W.C.1, not later than Thursday, 1st January, 1959, from which a selected number of firms will be invited to tender. 5863

CITY AND COUNTY OF BRISTOL
Education Committee

College of Technology

TENDERS are invited for supply of equipment for MECHANICAL AND ELECTRICAL ENGINEERING Departments of the College. First schedule of equipment now available. Firms wishing to tender for this and subsequent schedules should write to Chief Education Officer, Council House, Bristol, 1. Last date for receiving tenders for first schedule, 30th January. 5872

THE HERTFORDSHIRE COUNTY COUNCIL

invite applications for inclusion on their List of Contractors for building and maintenance works, heating and electrical works, fencing works, etc. Tenders will normally be invited from a number of firms on the list, but the County Council reserve the right to ask for other tenders.

Application forms from the Clerk of the County Council, County Hall, Hertford.

Contractors who have already applied for inclusion on the list need not apply again. 5855

BOROUGH OF MORLEY

Street Lighting: Trunk Road A.62

TENDERS are invited for the supply, erection and installation of 41 totally enclosed, non-cut-off type, 140-watt Sodium Lanterns mounted on 25-ft. concrete columns.

Specifications and forms of tender, upon payment of a deposit of £2 2s., which will be refunded after the receipt of bona fide tenders, will be supplied by the Public Lighting Engineer, Town Hall, Morley, to whom completed tenders should be returned not later than Friday, 16th January, 1959.

E. V. FINNIGAN,
Town Clerk.
Town Hall,
Morley, Yorks. 5864

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Orrin Project

Electric Lighting, Heating and Auxiliary Cabling Installation for Orrin Power Station and Dam, Ross-shire

TENDERS are invited for the above installation and cabling work. Tender documents may be obtained from the Engineers, Messrs. Merz and McLellan, 72a, George Street, Edinburgh, 2, on receipt of £2 2s. deposit (returnable).

The Board do not bind themselves to accept the lowest or any tender. 5865

SITUATIONS VACANT

MUNICIPALITY OF LIVINGSTONE
Northern Rhodesia

Appointment of Engineering Assistant Electricity Department

APPLICATIONS are invited from suitably qualified Electrical Engineers up to 28 years of age for the position as ENGINEERING ASSISTANT in the Town Electrical Engineer's Department at a salary in accordance with Grade 9 (£840 × £48 to £984 per annum), commencing at the minimum of the grade, plus a variable temporary cost-of-living allowance which is at present 26% of the basic salary.

Free unfurnished housing is normally provided, but if not immediately available, an allowance in lieu at the rate of £16 a month for a married officer and £8 a month for a single officer is payable.

The Council's conditions of service provide for contributory pension and medical aid schemes, together with assisted passages and generous leave provisions. The appointment will be subject to a probationary period of six months.

Abridged conditions of service may be obtained from the Commissioner for Northern Rhodesia, 57, Haymarket, London, S.W.1, to whom applications in duplicate on the lines of the application form for appointments used by the British Electricity Authority, accompanied by a recent medical certificate of fitness and copies of three recent testimonials, should be sent to arrive not later than 31st January, 1959.

Canvassing of councillors will disqualify candidates for appointment, and candidates must disclose whether they are related to any members or officers of the Council.

K. VALE,
Acting Town Clerk.
P.O. Box 29,
Livingstone, N.R.
10th December, 1958. 5873

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

THIRD ASSISTANT ENGINEER (System Standardisation). The successful applicant will be employed in the Sub-Area System Standardisation Section of the Commercial Department.

Applicants should have had some experience in the installation and maintenance of domestic and small industrial electrical equipment, and in preparing estimates of the cost of this class of work. They should be Corporate Members of the Institution of Electrical Engineers or possess technical qualifications leading thereto.

Salary N.J.B. Class M, Grade 10, £1,065/£25/£1,140 per annum.

FOURTH ASSISTANT ENGINEER (System Standardisation): Two Posts. The successful applicants will be employed in the Sub-Area System Standardisation Section of the Commercial Department.

Applicants should have had some experience in the installation and maintenance of domestic and small industrial electrical equipment, and in preparing estimates of the cost of this class of work. Technical qualifications will be an advantage.

Salary N.J.B. Class M, Grade 13, £885/£15/£930 per annum.

Applications, quoting 3 SAR, and giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 5th January, 1959.

No. 7 (Grimsby) Sub-Area
SCUNTHORPE DISTRICT

CONSUMERS' ENGINEER. Applicants should hold an appropriate technical qualification and should have sound training and experience in the work of a commercial department in the electricity supply industry. They should have experience in negotiations with all types of consumers requiring electricity supplies, tariffs, sales development and the control of staff.

Salary N.J.B. Class G, Grade 8, £885/£15/£930 per annum.

Applications, quoting 7 SAR, and giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than 5th January, 1959. 5848

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT ENGINEER is required at Nechells "B" Power Station, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade J.12, £790 to £835 per annum, plus 10% shift allowance.

Applicants should have received a sound technical training and should preferably have had experience in the control of the works supply system. Appropriate technical qualifications will be an advantage.

Apply, quoting Vacancy No. 898MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 8th January, 1959. 5844

Situations Vacant (continued)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Kincardine Generating Station

APPLICATIONS are invited for a superannuable position as SHIFT CHARGE ENGINEER at the above station.

Applicants should have had considerable experience in a responsible position of the operation of modern turbo-alternator plant and high-pressure boilers. Experience with pulverised fuel firing and unit operation is also desirable. Candidates should be in possession of a Higher National Certificate, or have equivalent qualifications, and preferably be corporate members of one of the senior engineering institutions.

Arrangements are being made to provide housing accommodation for the successful applicant.

The salary will be in accordance with Schedule A to the National Joint Board Agreement, i.e., Class K, Grade 7, £1,160/£1,235 per annum, rising ultimately to Class M, Grade 7, £1,325/£1,415 per annum, in both instances plus shift allowance of 10%.

Applications, on the standard form, should be submitted to the Secretary, South of Scotland Electricity Board, 168, Broomhill Drive, Glasgow, W.1, not later than 3rd January, 1959. Interested persons who have previously made application for a similar post at the station need only advise the Secretary that they wish to be considered for the current vacancy.

5847

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointment in this Division :—

STATION SHIFT CONTROL ENGINEER, DERBY POWER STATION (Vacancy No. 193/58/ER).

Applicants should have had a sound training and practical experience in a modern power station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be an advantage.

The salary will be within Class F, Grade 10 (£740–£785 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 7th January, 1959.

This appointment will be pensionable under the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

O. S. WOODS,
Divisional Controller.

15th December, 1958. 5857

SOUTH OF SCOTLAND ELECTRICITY BOARD

Stirling Area

A SENIOR COMMERCIAL ASSISTANT (Technical) is required for the Area Commercial Officer's Department at Stirling.

It is a condition of appointment that the successful applicant should possess a Higher National Certificate in Electrical Engineering, or an equivalent qualification.

Conditions of service will be in accordance with the National Joint Board Agreement for the Electricity Supply Industry. The post is superannuable.

The salary will be in accordance with said agreement, Class J, Grade 10, £885/£930 per annum.

Application forms, obtainable from the undersigned, are to be returned not later than 9th January, 1959.

JAMES G. CURTIS,
Area Manager.

Woodlands,
St. Ninians Road, Stirling.
10th December, 1958. 5866

FEDERAL POWER BOARD

Appointment of System Operation Engineer

THE Board requires the services of a SYSTEM OPERATION ENGINEER in connection with the forthcoming establishment in the Federation of an interconnected power supply system.

The system will comprise a 330-kV transmission Grid (approximately 900 circuit miles in length), the Kariba hydro-electric station (initial capacity 600 MW), now under construction, and a number of existing thermal stations. Load despatching and switching for the system will be carried out from a Central Control.

The System Operation Engineer will be responsible for the running of this Central Control and for engineering and economic studies of actual and future system operating conditions.

Applicants should be fully qualified electrical engineers with experience of the operation of large power supply systems, and should be acquainted with the economic as well as with the technical aspects of interconnected operation.

Salary £2,750 per annum. The successful applicant will be required to join the Board's pension scheme.

Applications should reach the Secretary, Federal Power Board, P.O. Box 630, Salisbury, Southern Rhodesia, not later than 1st February, 1959. 408

BRITISH STANDARDS INSTITUTION

AN ELECTRICAL ENGINEER is required by the British Standards Institution for work in an expanding section dealing with the approval of all types of electrical equipment. The work is of a varied and interesting nature and includes the investigation of all types of electrical equipment and appliances. Applicants should preferably have served an electrical engineering apprenticeship, and should have technical qualifications equivalent at least to Graduate Membership of the I.E.E. Applicants should have a good general knowledge and experience of the electrical industry, or alternatively good electronic experience.

There are three grades of appointment in this section of the Institution, and applications are invited for the lowest grade which has at present a maximum salary of £1,200, the starting figure being dependent on individual qualifications and experience. The post is pensionable.

The location of the appointment after April will be at Hemel Hempstead, and there should be no difficulty in arranging housing accommodation. The intervening two or three months will be spent at British Standards House.

Apply to the Establishment Officer, B.S.I., 2, Park Street, London, W.1. 5852

FISONS LIMITED

require an

ELECTRICAL DRAUGHTSMAN

for industrial lighting, power and distribution schemes. Applicants should have reached at least Ordinary National Certificate standard, and have experience of contract work.

Salary according to experience and qualifications. Pension scheme, including provision for widows.

Applications, with full particulars, to Group Personnel Officer (HU29), Harvest House, Felixstowe, Suffolk.

5861

DRAUGHTSMAN FOR HIGH-TENSION SWITCHGEAR

THERE is a vacancy in our modern drawing offices for a draughtsman with experience of 11-kV switchgear.

The position offers a five-day week and the advantages of a non-contributory pension scheme.

Apply in writing, giving full details to :—

The Personnel Manager
GEORGE ELLISON LIMITED
Perry Barr, Birmingham, 22B

5859

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule B. Salary includes London allowance. Qualifications entitling to Graduate Membership of I.E.E. or I.Mech.E. an advantage.

FOURTH ASSISTANT ENGINEER (Efficiency and Testing), GENERATION (Operation) DEPT. (Vacancy No. 58/1085).

The appointment is situated at Barking Power Station. Candidates should have a good technical education and some experience in testing power station mechanical plant. Salary Class AX/EX, Grade 7 = £860/£1,085 p.a.

FOURTH ASSISTANT ENGINEER, GENERATION (Operation) DEPT., DIVISIONAL H.Q. (Vacancy No. 58/1086).

Sound technical training with knowledge of power station plant operation. Duties will include collecting and compiling data, also dealing with reports and investigations. Salary Class AX/EX, Grade 8 = £750/£985 p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 5th January, 1959. 5877

LONDON ELECTRICITY BOARD

Demonstrator (Female)

APPLICATIONS are invited for the above position in the Western District, based initially at Shepherds Bush, London, W.12.

Applicants should be suitably qualified, holding the E.A.W. or other approved certificate including electrical housecraft, and having experience in conducting demonstrations at service centres and general service centre duties. They should also be experienced in advising consumers on the selection and use of domestic appliances, both at the service centre and on consumers' premises.

The post is graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 1, i.e., £550 to £665 per annum, inclusive of London area allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within 14 days of the publication date of this vacancy. Please quote ref. PER/2549/R. 5876

THE ELECTRIC CONSTRUCTION COMPANY LIMITED

has

AN ATTRACTIVE VACANCY

for

PLANT SALES ENGINEER

for Scotland—based on Glasgow Office.

Applicants must have sound connection amongst industrial users and resellers of electrical plant. Preferably with good knowledge of motors and/or control gear.

Apply in writing giving full details of training, experience, present position and salary to :—

The Area Manager for Scotland
The Electric Construction Company Ltd.
Bushbury House
5, Woodlands Terrace, Glasgow, C.3

(All applications will be treated in strict confidence.)

5849

BERMUDA ELECTRIC LIGHT CO. LTD.

THE company have a vacancy for a first-class REFRIGERATION MECHANIC. Three-year contract offered in first instance. Assistance will be given by the company to find unfurnished accommodation if necessary. Pension scheme operated.

Applicants should forward full details of themselves, their training and experience to : Messrs. Mackness & Shipley, Consulting Engineers, Parliament Mansions, Abbey Orchard Street, London, S.W.1, quoting reference 2203/65.

5834

THE ELECTRICITY COUNCIL

Press and Information Officer

THE ELECTRICITY COUNCIL invite applications for the superannuable appointment of PRESS AND INFORMATION OFFICER at Headquarters, Charing Cross, London.

The successful candidate should be an experienced journalist familiar with Press liaison work. In addition to other duties he will be responsible for the circulation of Press information within the electricity supply industry, and will also edit and undertake production of publications. Some background knowledge of the industry is essential.

Salary within the scale £1,960-£2,160 p.a. inclusive.

Applications stating age, experience, present position and salary to E. Landucci, Winsley Street, London, W.1, by 9th January, 1959. Quote ref. C.25. 5856

EXCEPTIONAL OPPORTUNITY

for experienced Sales Executive to join virile progressive group in electrical industry as

SALES MANAGER

of their Electrical Accessory Company. Successful candidate will have :—

1. Enthusiasm, energy and proven sales ability in the field.
2. Managerial experience, preferably in the electrical trade.
3. Sound education, together with adaptability and inquiring mind.
4. Age 30/45, and live or prepared to reside near Manchester.

Concise but relevant details to include past employment and salaries earned.

Box 5853

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

OPERATION SUPERINTENDENT is required at Meaford "A" Power Station, Stone, Staffs. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade G.5, £1,065-£1,140 per annum.

Applicants should have received a sound technical and practical training, and should have considerable experience in the operation and maintenance problems arising in a power station. The possession of a recognised technical qualification will be an advantage.

Apply, quoting Vacancy No. 896MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 8th January, 1959. 5845

DRAUGHTSMAN FOR MEDIUM-VOLTAGE CIRCUIT BREAKERS

WE are looking for a draughtsman, with sound knowledge of medium-voltage air break circuit breakers, to fill a position that offers excellent opportunities for a man of initiative, capable of working with the minimum supervision.

Our staff work a five-day week in modern offices and participate in a non-contributory pension scheme.

Apply in writing, giving full details to :—

The Personnel Manager
GEORGE ELLISON LIMITED
Perry Barr, Birmingham, 22B

5858

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

MAINTENANCE ENGINEER (Mechanical) is required at Worcester Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade E.6, £885 to £930 per annum.

A sound technical training and practical experience in power station mechanical maintenance is required, and the possession of appropriate technical qualifications will be an advantage.

Apply, quoting Vacancy No. 897MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 8th January, 1959. 5846

ALDERNEY ELECTRICITY LTD.

Alderney, Channel Islands

RESIDENT MANAGER required for Statutory Island Electricity Supply Company with output approaching one million units per annum from an A.C. diesel generating station. The distribution network consists of overhead and underground 11 kV and L.V. mains. One showroom. Contracting carried out. Applicants should be energetic practical engineers with operating and contracting experience. The company is associated with and guided by Christy Bros. Ltd.

Starting salary approx. £750 p.a. having regard to applicant's experience with progressive increases depending on results obtained.

Full details of age, experience, qualifications and salary required should be given in the application which should be made in writing to Christy Bros. Ltd., Electrical Engineers, Chelmsford, Essex, England. 5799

CITY OF WAKEFIELD EDUCATION COMMITTEE

Technical and Art College

APPLICATIONS are invited for the post of full-time ASSISTANT GRADE B to teach Electrical Engineering and allied subjects to Ordinary National Certificate standard. Candidates should possess Degree in Electrical Engineering or equivalent qualifications and should have had teaching or industrial experience.

Form of application and further particulars relating to the appointment may be obtained from the undersigned on receipt of a stamped addressed foolscap envelope.

C. L. BERRY,
Director of Education.

Education Department,
27, King Street,
Wakefield. 5860

AN opportunity occurs for responsible editorial work on an established industrial technical journal in London. Applicants should have wide knowledge of steam, electrical and other equipment, particularly for industrial purposes. The post might suit an experienced charge engineer, having the H.N.C. and wanting to leave shift work. Send particulars of career to—Box 5862.

AN opportunity to learn electrical circuit work in a drawing office: London Transport offers training in drawing office of signal engineer to men holding Ordinary National Certificate in Electrical Engineering, who are interested in a career in railway power signalling. Suitable candidates will be engaged in preparation of circuit diagrams and other drawings for signalling work for capital works programme. No previous drawing office experience required. Salary range £438 (at age 20) rising to £767 p.a. Commencing rate £438 (age 20), £541 (age 24), £675 (age 29 and over). Extra payments for Higher National Certificate, degree or recognised equivalents. Contributory superannuation scheme; free travel; 38-hour week; no Saturday working. Please apply to Staff and Welfare Officer (F/EV 719/4), London Transport, 55, Broadway, London, S.W.1. 5867

COMMISSION representatives wanted in most areas, calling on retailers to sell the Timostat, combined time switch and thermostat. Write — Herga Electric, 5, Northolt Road, Harrow. 5854

CONSULTING engineers have vacancy for an assistant draughtsman for lighting schemes in hospitals, private buildings, etc. The position is permanent and offers experience on the mechanical side for a keen and ambitious applicant. Five days per week, three weeks' holiday. Apply in writing to Senior Partner, Harding, McDermott & Partners, 17, Doughty Street, London, W.C.1. 9580

CONTROL gear engineer required, age 23-35, for layout and circuiting of contactor equipment. Experience of lift equipment would be an advantage. Permanent and progressive position. Good salary. Canteen. Pension scheme. Write stating age, experience and qualifications, if any, to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Rd., Hounslow, Middx. 5721

ELECTRICAL engineer, H.N.C., with automatic control, circuit and instrument experience, to work in connection with automatic weighing and bulk material handling equipment. Salary £850-£1,000 according to experience. Apply to Richardson Scale Company Ltd., Albert Street, Bulwell, Nottingham. 5835

DRAUGHTSMEN required by manufacturers of medium-voltage metalclad switchgear for their contracts drawing office. Bonus and non-contributory superannuation schemes in operation. The company is within six miles of the South Devon coast. Write, stating previous experience, age and salary required, to Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 5722

ELECTRICAL wholesaler requires experienced male staff for despatch department and stores. Apply—Newey & Eyre Ltd., 243, Horn Lane, London, W.3. 9578

ESTABLISHED and well-known electrical contractors in the South-West have a vacancy for a fully qualified and experienced estimating/supervising engineer. Apply in writing stating age, experience and other relevant details to Box 3032, Blackford's Advertising, Bristol. 5878

INTERESTING position open with an important cinema organisation for a young enthusiastic engineer with practical electronic experience in a new and expanding field in the cinema industry. Must be prepared to travel within the British Isles. State age, education, training, experience and salary required to—Box 5794.

MANAGER for electrical repair shop. Must be accustomed to all types and sizes of rewinds and repairs. Commercial experience an advantage. Apply in writing to—Simpson Brothers (of Hapton) Ltd., Hapton, Nr. Burnley. 5843

PRIME cost clerk, fully experienced, required by leading London electrical contractors. Write stating age, experience and salary required.—Box 5822.

YOUNG electrical engineer with production experienced required.—Box 5879.

YOUNG engineer (mech.) required, age 25-35 years, with experience of labour control. To take charge of production department in electronic components field. Write in confidence.—Box 5874.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

COMMERCIAL executive, university graduate, A.M.I.E.E. (47), steam power station and all-round engineering sales experience, fluent German and French, some Spanish, desires change.—Box 9575.

EXPERIENCED elect. engr. seeks London post. Interesting work more important than high salary.—Box 9576.

ARTICLES FOR SALE

WARD LEONARD SETS

each with motor generator set incorporating separately excited generator, direct coupled to driving motor wound for 400/440 volts, 3-phase, 50 cycles, with control gear.

Work motor details :—

0/370 h.p., BRUCE PEEBLES, 0/220 v., 0/1500 r.p.m., drip-proof.
0/225/225 h.p., HARLAND, 0/250 v., 0/1450/1750 r.p.m., vertical.
0/200/200 h.p., G.E.C., 0/220 v., 0/750/1000 r.p.m., enc. ventilated.
0/195/195 h.p., HARLAND, 0/220 v., 0/1100/1750 r.p.m., drip-proof.
0/150 h.p., MET. VICK., 0/500 v., 0/1500 r.p.m., drip-proof.
0/150/150 h.p., L.S.E., 0/500 v., 0/700/1600 r.p.m., screen protected.
0/120 h.p., G.E.C., 0/220 v., 0/960 r.p.m., screen protected.
0/100/100 h.p., L.D.C., 0/220 v., 0/750/960 r.p.m., screen protected.
0/73/73 h.p., HARLAND, 0/480 v., 0/1250/1550 r.p.m., drip-proof.
0/35/35 h.p., B.T.H., 0/480 v., 0/1250/2000 r.p.m., screen protected.
0/33/33 h.p., MAWDSLEY, 0/250 v., 0/1000/1350, drip-proof.
1.67/16.5 h.p., B.T.H., 90/250 v., 480/2160 r.p.m., totally enclosed.

A number of smaller units also available.

GEORGE COHEN, SONS & CO. LTD.
600, Wood Lane, London, W.12
(Tel. Shepherds Bush 2070) and
Stanningley, Nr. Leeds
(Tel. Pudsey 2241) 5748

Articles for Sale (continued)

ELECTRICAL EQUIPMENT FOR SALE

1 20-kW rating B.T.H. Frequency Changer Set complete with control panel, output 3-phase, 127 volts, 200 cycles.
6 HI-CYCLE Drilling Machines, 5/16" capacity.
6 HI-CYCLE Sanding Machines, 7" dia. pads.
2 HI-CYCLE Metal Shearing Machines, 14" gauge.

£400 o.n.o.

Can be seen working by arrangement with Works Engineer, Desborough Engineering Co., Lancaster Road, High Wycombe (Tel. 1665). 5880

WHITEFIELD MACHINERY & PLANT LIMITED
Cobden Street, Salford, 6

VARIABLE SPEED COMMUTATOR MOTORS, 400 VOLTS, 3-PHASE, 50 CYCLES

H.P.	Maker.	R.P.M.
65 - 16	B.T.H.	1500 - 360
65 - 16	B.T.H.	1500 - 360
65 - 16	B.T.H.	1500 - 360
65 - 16	B.T.H.	1500 - 360
43 - 17	L.S.E.	1900 - 750
40 - 8	B.T.H.	1150 - 230
30 - 7.5	B.T.H.	1500 - 375
30 - 6.6	L.S.E.	2250 - 500
5 - 1.7	L.S.E.	2250 - 750
5 - 1.7	L.S.E.	2250 - 750
4 - 1	B.T.H.	1650 - 413
4 - 1	B.T.H.	1650 - 413

Telephone : Pendleton 4746

307

GENERATING EQUIPMENT FOR SALE

1 HOUCHIN-GENERAL MOTORS Direct Coupled Diesel Alternator, 100 kVA, 400 v., 3-phase, 4-wire, 50 cycles.
1 CUMMINGS/WESTINGHOUSE Direct Coupled Diesel Alternator, 33 kVA, 400 v., 3-phase, 4-wire, 50 cycles.
1 HERCULES/G.E.C. Direct Coupled D.C. Generator, 65 kW, 440 v., 2-wire into a Balancer Unit.

Can be seen in the London area.
Box 5881

ELECTRICAL EQUIPMENT FOR SALE

10-kVA/10-h.p. D.C. and A.C. School or Laboratory Test Set. Output 25 to 60 cycles and 150/500 volts D.C.
Reconditioned Motors.
3-kVA, 230-volt, 1,000/1,100-cycle M.G. Set. Diesel Alternator Sets.
562-kVA, 300-r.p.m. Alternator, 400/440/3/50 cycles.
Secondhand 5-cwt. Electric Blocks.

SOUTHERN & REDFERN LTD.
Woodhead Road, Bradford, 7
(Tel. Bradford 23871) 404

ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., s/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY
Fairfax Works, Fairfax Rd., London, N.8
(Tel. MOUntview 7944, 6373) 191

HOUSE SERVICE METERS

200-240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.
221, City Road, London, E.C.1 37

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd., London W.4. 57

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALTERNATORS, generators, 1-588 kVA, all voltages. Specialists—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 140/-. See Quarterly.—Tradex, Surbiton. 170

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CABLE, underground, all types ex stock.—E. M. Tatton Co., Ltd., Kew Bridge, Brentford (EALing 3155/6). 117

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS and motor-alternators, 24, 110 and 220 v. D.C. to 230/1/50 A.C., 300 watts to 6 kVA in stock.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

FLUORESCENT fittings, lamps, starters and control gear for home and export. Fully guaranteed by actual manufacturers. Send for catalogues.—The Anglo-American Electrical Company, Olive Street, Bury, Lancs. 245

FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—The Anglo-American Electrical Company, Bury New Road, Breightmet, Bolton, Lancs. (Telephone, Bolton 7251). 212

FOR sale, good, unused and used machinery, including electric motors, A.C. and D.C., dynamos, transformers, diesel and steam electric generating sets, mains failure sets, motor generator and Ward Leonard sets, switchgear, compressors, fans, capacitors, etc.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1). 161

FREQUENCY changers and variable frequency M/A sets in stock, and to specification.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 148

GENERATING plants of all types, new and reconditioned up to 100 kVA in stock. Special plants built to order at short notice; automatic mains failure, etc.—Powerco Ltd., 312, York Rd., London S.W.18 (VAN. 5234). 151

HIGH frequency alternators and converters, 400 to 2,600 cycles up to 6 kVA in stock. Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 149

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTOR generators of all types in stock and to specification up to approx. 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 152

MOTORS and control gear, huge stocks all types, ½ to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (3774/5/6). 70

NAMEPLATES, engraving, diesinking, stencils.—Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

PREPAYMENT 1s. slot house service meters.—Universal Electrical, 217-221, City Road, London, E.C.1. 36

PURLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switchholder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. F. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

QUARTERLY credit meters, single and polyphase, 2½-100 amps. From 17/6d. Also D.C. See Television.—Tradex, Surbiton. 171

ROTARY converters in stock, all sizes; enquiries invited.—Universal Electrical, 221, City Road, London, E.C.1. 34

SECONDHAND electrical plant can be as good as new if you buy it from specialists. Write for our stock list.—Dynamo & Motor Repairs Ltd., North End Road, Wembley Park, Middlesex (Telephone, Wembley 3121); Soho Road, Handsworth, Birmingham (Telephone, Birmingham Northern 0898). 73

SLYDLOK fuses for sale.—Ryness Supplies, 37, Goodge Street, London, W.1. 284

SMALL BR screws and nuts in steel, brass and stainless steel, from stock.—Premier Screws & Repetition Co. Ltd., Woodgate, Leicester. 180

STEAM boiler for sale. One Bouellat B-type boiler, size 100/B.S. 4600/36, having an evaporation of 5,930 lb. hr. W.P. 100 p.s.i., arranged for oil firing with Hamworthy rotary cup burner. An important feature is high output for small floor area. This is a new boiler now ready for delivery, but not required by buyers owing to change of policy.—Box 5868.

TELEVISION slotmeters and time switches. Details from: Tradex Meter Co., Surbiton. Elmbridge 4487. 172

TIME switches from stock. Reconditioned or new. 12 months' guarantee. Lists from—J. W. Hughes, 3, St. Thomas Street, London Bridge, London, S.E.1 (Tel. HOP 2759). 178

VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

WARD Leonard motor generating sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

2 cwt. of bakelite strip paper base, 1¼" wide × approx. 24" long × .015/.019" thickness, and about 200 lb. of bakelite strip fabric base, 3½" wide × approx. 50" long × ⅛" thickness.—Box 5869.

2 370-kW, 115-v., 2-wire D.C. generators, as new, with 2 Ruston Class VEBX, size 6, 540-h.p. at 500-r.p.m. direct-coupled oil engines and Whipp & Bourne D.C. panel complete with smoothing equipment.—E. M. Tatton & Co., Kew Bridge, Brentford (Ealing 3155). 5814

400-cycle to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 27

500-kW, 220-volt Met.-Vick. rotary converter, with transformer 11,000 volts, 3-phase, 50 cycles, and accessories.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 17

SALES BY AUCTION

Thirty-fifth Sale

E R

By Order of the Secretary of State for Air

No. 25 MAINTENANCE UNIT, ROYAL AIR FORCE, HARTLEBURY, Worcestershire
(4 miles from Kidderminster, 11 miles from Worcester)

NOCK & JOSELAND

are instructed to SELL BY AUCTION at the above Unit on

THURSDAY, 8th JANUARY, 1959

at 11 a.m. prompt

a Large Quantity of

VALUABLE MISCELLANEOUS STORES

including

Clothing and Equipment, Footwear and Cordage, Cameras and Photographic Equipment, Office Furniture, RADIO AND ELECTRICAL EQUIPMENT, General Stores.

VIEWING: The Lots are on view at Hartlebury on Wednesday, 7th January, 1959, between the hours of 9 a.m. and 4 p.m., and on the morning of the Sale Day between the hours of 8 a.m. and 11 a.m.

ADMISSION only on production of Catalogue, which will admit two persons on the View Day and one person on the Sale Day. The Secretary of State for Air reserves the right to refuse admission. Catalogues, price ONE SHILLING EACH (postal orders, NOT stamps), can be obtained from the Auctioneers:

NOCK & JOSELAND
Bank Buildings, Kidderminster
(Tel. 2053 & 4211) 5850

EQUIPMENT FOR HIRE

GENERATING set hire service. Consult the most experienced firm for A.C. and D.C. units from 2 kW to 240 kW, diesel or petrol, stationary or mobile, sale or hire. 24-hr. breakdown service. — Dawson-Keith Ltd., Hillview Rd., Sutton, Surrey (Fairlands 4401). 46

RELIABLE, self-contained diesel electric generating sets for hire, 2.5 to 260 kW. Night and day maintenance service. Quotations by return. — Whitetrade Limited, Rochester, Kent (Tel. Chatham 41133, 3 lines). 294

ARTICLES WANTED

HARRINGTON & Sons, reclamation contractors, want redundant A.C./D.C. electric motors and transformers, stocks of cable, etc.—109, Beaconsfield Street, New Beckton, East Ham, London, E.6 (ALB. 1388). 315

JOURNALS, periodicals, technical and scientific, wanted to buy for cash. Back volumes and sets.—E. R. Ashley, 27, East 21, New York, 10, N.Y., U.S.A. 61

MERCURY (Quicksilver) wanted. Write for packing instructions. Gold, silver and platinum also purchased.—Collingridge & Co. Ltd., Riverside Works, Riverside Rd., Watford (Tel. 5963). 114

QUICKSILVER & beryllium copper urgently required for best prices and prompt cash.—Sterling Products Ltd. (Ealing 9248). 293

SURPLUS laminations, enamel copper wire, screws, nuts, flex. Good prices paid. Full details to—Box 199.

WANTED, D.C. and A.C. ball-bearing motors, motor generator sets, dynamos and alternators. Full details to — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 13

WANTED for prompt cash, ferrous and non-ferrous scrap, also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. & H. Cooper Ltd., 176, Brady St., Bethnal Green, London, E.1. 120

WANTED, rotary converters, any sizes.—Universal, 221 City Rd., London E.C.1. 35

WANTED, surplus stock cable, all types and sizes. We can inspect.—Box 220.

EDUCATIONAL

MIDDLESEX COUNTY COUNCIL

Education Committee

HENDON TECHNICAL COLLEGE
The Burroughs, Hendon, London, N.W.4

THE following courses, to be held on Mondays from 7 to 9 p.m., are for Graduates or holders of a Higher National Certificate. The fee for each course is 20s.

Transistor Applications

Eight lectures, commencing 19th January. Lecturer, J. I. Missen, A.R.C.A., M.Sc.

The syllabus will include semi-conductor diodes, rectifiers and P-N-P-N switching devices, Junction transistor circuits, Equivalent circuits, Design of audio frequency amplifiers, Power output stages—efficiency, distortion. Design of heat sinks, High frequency amplifiers—tuned and broad band amplifiers, Oscillators—sinusoidal and relaxation circuits, The transistor as a switch—rise and fall time—computer circuits, Non-linear and other applications of transistors—stabilised power supplies, d.c. convertors.

Elements of Numerical Methods

Ten lectures, commencing 19th January. Lecturer, A. T. F. Nice, M.A.

The syllabus will include finite differences and interpolation, Numerical differentiation and integration, Approximate solution of equations—iterative methods, Linear equations and matrics. Ordinary differential equations.

Application should be made to the Principal.

C. E. GURR, M.Sc., Ph.D.,
Secretary to the
Education Committee.
5851

CITY and Guilds (Electrical, etc.) on "No pass—No fee" terms. Over 95% successes. For details of modern courses in all branches of electrical engineering, applied electronics, automation, etc., send for our 148-page handbook—free and post free.—B.I.E.T. (Dept. 12a), 29, Wright's Lane, London, W.8. 10c

WORK WANTED AND OFFERED

A.C. and D.C. motor rewinds and repairs. Prompt service, fully guaranteed.—Edgware 5566/9; Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. 92

TURNED WORK in all plastics for the electrical trade. Quotations on receipt of drawings.—Critchley Bros. Ltd., Brimscombe, Stroud, Glos. 236

AGENCIES

DISTRIBUTORS wanted for attractive fluorescent units. Some exclusive areas vacant.—Box 5576.

IMPORTANT firm of wholesale electrical distributors in Salisbury, S. Rhodesia, wish to contact manufacturers of unit construction type metal switchgear, also household and commercial electrical appliances, with a view to sole distribution arrangements. Further particulars from—Landau & Coetsee Ltd., Dominion Buildings, South Place, Finsbury Pavement, London, E.C.2. 5871

BUSINESSES FOR SALE AND WANTED

OWNERS of old-established and profitable electrical wholesale business in London would consider disposal as going concern after March, 1959. Apply Birkbeck, Julius, Coburn & Broad, Solicitors, Roman House, Cripplegate Buildings, London, E.C.2. 5824

PATENT NOTICES

THE proprietor of Patent No. 658869 for "Finger type circuit regulator" desires to secure commercial exploitation by licence or otherwise in the United Kingdom. Replies to—Haseltine Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2. 5870

BOOKS, INSTRUCTIONS, ETC.

FOUNDATIONS of Wireless. Seventh edition. M. G. Scroggie, B.Sc., M.I.E.E. To keep pace with modern developments this edition has been almost entirely rewritten, a great deal of material has been added, and the order of some of the sections rearranged. In fact, it may be regarded as an entirely new book, but it nevertheless retains that easy style which has commended it to the countless thousands who have gained their first acquaintance with radio from this book since it was first published 22 years ago. It covers the whole basic theory and, starting from the most elementary principles, and assuming no previous knowledge on the reader's part, deals with receivers, transmitters, amplification, valves, transistors, aerials, power supplies and transmission lines. Although the backbone of the book is still sound broadcasting, in the present edition there is more emphasis throughout on f.m., v.h.f. and television, and the television, and the treatment of frequency changers has been rewritten from the standpoint of modern practice. Earth-grid and cascade v.h.f. amplifiers, colour television, e.n.t. generators and transistor voltage raisers are included for the first time, and transistors have been treated in greater detail than hitherto. 15s. net, from all leading booksellers. By post 16s. 4d. from Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1.

INDUSTRIAL BRAZING

The first full-length study of this subject.

By H. R. Brooker and E. V. Beatson, B.Sc.(Eng.), A.M.I.E.E.

Industrial brazing as a process for metal fabrication has advanced to such an extent that those engaged in the work have found difficulty in keeping pace with its many developments. This book, written by two leading authorities, covers all modern brazing methods including torch, furnace, high-frequency induction, resistance, salt bath and dip, with chapters on the special techniques necessary for aluminium, stainless steels, beryllium copper, cemented carbides and vacuum tube construction.

35s. net. By post 36s. 6d.

Obtainable from all booksellers or direct by post from the address below

Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1

HOUSE SERVICE METERS

Credit Pattern
and Prepayment Type

200-240 v. A.C. S/Ph 50 c. (& D.C.)

AVAILABLE FROM STOCK

POLYPHASE 400-440 v. 3-Wire Type

Ex Stock

UNIVERSAL ELECTRICAL CO.
217-221 City Road, London, E.C.1

ELECTRICAL
WHO'S WHO 1958 - 59

Essential to all in the electrical industry

When the first edition of ELECTRICAL WHO'S WHO appeared in 1950 it was hailed as a reference book which met a long-standing need.

The fifth edition of this comprehensive personal directory contains some 8,000 biographies of people in all branches of the industry, showing education, training, careers to date, membership of associations and private addresses, with an additional alphabetical listing of firms and organizations in the industry, with their principals.

The 1958-59 ELECTRICAL WHO'S WHO should be on YOUR desk.

27s 6d net BY POST 29s 3d

from leading booksellers

Electrical Review Publications Ltd. Dorset House Stamford Street London S.E.1

ELECTRIC SHOCK

ALL MEN ENGAGED DIRECTLY OR INDIRECTLY IN ELECTRICAL WORK SHOULD KNOW THOROUGHLY A METHOD OF RESTORING VICTIMS OF ELECTRIC SHOCK

INSTRUCTION SHEET

based on the HOLGER NIELSEN System and specially prepared by the Editorial Staff of

ELECTRICAL REVIEW

Well illustrated and printed in colour to simplify essential actions

Obtainable from
PUBLISHING DEPT.
DORSET HOUSE
STAMFORD STREET
LONDON · SE1

The "ELECTRICAL REVIEW" Wall Sheet, 20 in. x 15 in., printed in red and black, is available on chrome art paper at 8d. each (by post 10½d.), mounted on cardboard and varnished 5s. (by post 6s. 6d.), printed direct on aluminium sheet and varnished 8s. (by post 9s. 6d.).

STEEL SHELVING

72" HIGH
34" WIDE
12" DEEP

- *Brand new—Manufactured in our own works*
- *Shelves adjustable every inch*
- *Heavy gauge shelves will carry 400 lbs. each*
- *Stove enamelled bronze green*
- *6 shelves per bay—Extra shelves 8/- each*
- *Quantity discounts*

DELIVERED FREE
£3.15.0
Ready for Erection

N. C. BROWN LTD.

Rochdale Road Works
HEYWOOD · LANCS
—the manufacturers!

ALL OTHER SIZES available at equally keen prices.

Telephone: Heywood 69018 (3 lines)

SM/FP 3853/1

DOMESTIC WATER HEATING

BASIC ENGINEERING PRINCIPLES OF ELECTRIC AND SOLID-FUEL INSTALLATIONS

By Ronald Grierson,
M.I.E.E., M.I.MECH.E.

Besides setting out the principles of the subject, this book gives a critical analysis of current practice in the supply of hot water for domestic purposes. The author deals mainly with the combination of an electric immersion heater and thermostat with a conventional hot-water storage tank, in conjunction with a coal- or coke-fired domestic water heater, this being arranged either as a "back-boiler" or as an independent unit

25s. net. By post 26s.

Obtainable from all booksellers or direct from:

PUBLISHING DEPT.
DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

A MUST for jointing cables successfully, particularly P.V.C. No wiping required on V.I.R. L.C.S.W.A.S. Cables.

Extremely robust rectangular boxes, i.e. through, tee or fourway. Note the space for jointing and ease of filling with compound. For surface or underground use. Manufactured from Cast Iron only at present, with a wide range of sizes.

Tubular type for compactness and ease of assembly on P.V.C. Cable. Manufactured in Brass, or Mild Steel (Cadmium Plated).

These boxes can be used in conjunction with any of the series of 'Hawke' Cable Glands, both are protected by various patents.

Write for further details to the
SOLE MANUFACTURERS
HAWKE CABLE GLANDS LTD. ASHWORTH STREET, DENTON, LANCS.
Telephone: Denton 3868-9

Hawke

★ **The new 3 WAY**

Grelco

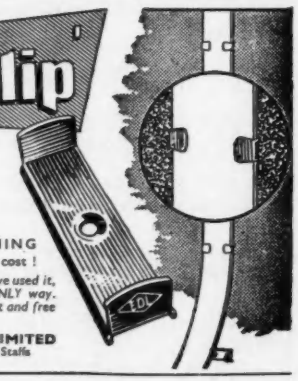
ADAPTOR
List No. MW 3/5/2
5 AMP 3 Pin
OUTLETS: One 5 or 2 Amp 3 pin
Two 5 Amp 3 pin

★ *Does not obstruct socket switch!*
★ *Access to all outlets irrespective of skirting board height!*
Supplied in BROWN or WHITE

This attractive
DISPLAY STAND
is now available with or without Adaptors
Write for details .... Today

GRELCO LTD. MINEHEAD · SOMERSET
Telephone: MINEHEAD 740
LONDON OFFICE: 123a Gloucester Road
South Kensington, London, S.W.7
Telephone: FREmantle 3371

'Strip-Clip'



A BETTER
SIMPLER
QUICKER
way of fixing COPPER EARTHING STRIP ... at a quarter the cost!

E.D.L.

Once you have used it, it is the ONLY way. Write for list and free samples.

THE ELECTRIC DEPOT LIMITED
Redbrook Lane, Brereton, Rugeley, Staffs
Phone: Rugeley 711

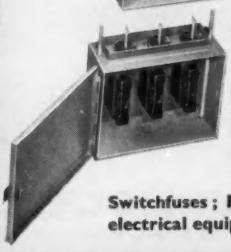
MERCURY SWITCHES

will solve your switching problems
We offer completely reliable switches
coupled with good delivery

Write for catalogue

QUICKSILVER TUBE MFG. COMPANY
Willow Road, Poyle Estate, Colnbrook, Bucks.
Tel.: Colnbrook 2382

Busbar trunking has been manufactured by The Power Centre Company for over quarter of a century. The picture shows part of a 12,000 feet installation supplying 3,000 kVA in a large engineering works and forms an essential part of the electrical installation of this modern factory. It provides a flexible system of power distribution using the minimum of space, is neat, safe and simple to install. Our standard range covers 100 to 2,000 amps.



We also manufacture **Busbar Chambers; Switchboards; Cable Trunking; Cable Tap Systems; Busbar Rising Mains; Fuse Units; Switchfuses; Fuseboards and special electrical equipment.**

THE POWER CENTRE CO. LTD.

Lloyd Street, Wednesbury, Staffs

Phone: Wednesbury 1131. Grams: "Powcent, Wednesbury"

LONDON OFFICE:
Wharf Estate, Ealing Road, Alperton, Middx.
Telephone: WEMbley 8866

A TI Company

EA

Aberdare Cables Ltd. ..... Cover 1
Airscrew Co. & Jicwood Ltd. 36
Allen West & Co. Ltd. 45
Anglo-American Vulcanized Fibre Co. Ltd. 33
Arcolectric Switches Ltd. 20
Armorduct Cable Co. Ltd. 74

Banner Electric Co. Ltd. 36
Barns, W., & Son (Holloway) Ltd. 56
Bill Switchgear Ltd. 3
Birch, H. A., & Co. Ltd. 24
Bray, E. N., Ltd. 27
British Klockner Switchgear Ltd... 8
British Thomson-Houston Co. Ltd. 5
Brotherhood, Peter, Ltd. 24
Brookhirst Switchgear Ltd. 51
Brown, N. C., Ltd. 69
Brush Electrical Eng. Co. Ltd. 38

Chamberlain & Hookham Ltd. 62
Colne Switchgear (K & W) Ltd. ... 52
Coughtrie, J. & G., Ltd. 12
Cox-Walkers Ltd. 54
Contractors, Electrical, Regional Guide to ..... 59 & 60
Cressall Mfg. Co. Ltd. 55
Critchley Bros. Ltd. 30
Crofts (Engineers) Ltd. ..... 28 & 29
Curtis Mfg. Co. Ltd. 54

Dacier Ltd. 16
Daly (Condensers) Ltd. 44
Dubilier Condenser Co. (1925) Ltd. 43

E.F. Electric Ltd. 14
E. I. Du Pont de Nemours & Co. (Inc.) 21
Electric Depôt Ltd. ..... 47 & 70
Electric Elements Co. 57
Electrical Who's Who 68
Ellison, Geo., Ltd. 37
Eltron (London) Ltd. 54
English Electric Co. Ltd. 18
Evans, F. W., Ltd. 51
Everett Edgcumbe & Co. Ltd. 40
Excelall Metal Workers Ltd. 14

Ferguson Pailin Ltd. 49
Ferranti Ltd. 31
Field & Grant Ltd. 35
Fitter & Poulton Ltd. 69
Frost, N. T., Ltd. 54

Gaskell & Grocott Ltd. 74
Geipel, W., Ltd. 69
General Electric Co. Ltd. ..... 10 & 11
Godwin, H. J., Ltd. 72
Greenwood Airvac Conduits Ltd. ... 25
Greico Ltd. 70
Griffiths, Gilbart Lloyd & Co. Ltd. 36
Guide to Electrical Contractors, Regional ..... 59 & 60

Harvey, G. A., & Co. (London) Ltd. 51
Hawke Cable Glands Ltd. 70
Heatrae Ltd. 1
Heaven, Dowsett & Co. Ltd. 52
Heys, Leonard, Ltd. 14
Howells (Electric Motors) Ltd. 42

L.P.S. Electrical Co. Ltd. 56
Lancashire Dynamo Nevelin Ltd. Cover 4
Litholite Insulators & St. Albans Mouldings Ltd. 55
Liverpool Electric Cable Co. Ltd. ... 58

Martindale Electric Co. Ltd. 43
Metropolitan-Vickers Electrical Co. Ltd. 9
Midland Dynamo Co. Ltd. 52
Midland Electric Mfg. Co. Ltd. 4
Monmore Conduits Ltd. 32
Morris, John, Electrical Eng. Co. Ltd. 57

Neco Geared Motors Ltd. 32
Neo Electrical Industries Ltd. 74
New Welbeck Ltd. 42
Nife Batteries 17

Oldfield Electrical Repairs 72
Ormond Eng. Co. Ltd. 50
Otter Controls Ltd. 8

Permali Ltd. 6
Pitman, Sir Isaac, & Sons Ltd. 47
Power Centre Co. Ltd. 71

Quicksilver Tube Mfg. Co. 70

Rawlings Mfg. Co. Ltd. 30
Reyrolle, A., & Co. Ltd. 26
Rich & Pattison (B'ham) Ltd. 44
Richardsons, Westgarth (Hartlepool) Ltd. 15
Rist's Wires & Cables Ltd. ..... Cover 2
Rix, G. A. 48
Robinson, D., & Co. 74
Robinson, L., & Co. Ltd. 57
Rolco Engineering Ltd. 14
Rowlands Electrical Accessories Ltd. 22
Runbaken Electrical Products 36

Sanders, W., & Co. (Wednesbury) Ltd. 46
Selecta Power Tools Ltd. 47
Siemens Edison Swan Ltd. 41
Silentbloc Ltd. ..... Cover 3
Sims, F. D., Ltd. 57
Smith & Nephew Ltd. 2
Sperryn & Co. Ltd. 16
Standard Telephones & Cables Ltd. 61
Statter, J. G., & Co. Ltd. 23
Stewart Transformers Ltd. 56

Thermal Elements 74
Transformer & Electrical Co. Ltd... 55
Turnock, Geo., Ltd. 72

Universal Electrical Co. 67
Utilities (London) Ltd. 35

V.G. Porcelain Co. Ltd. 48
Vent-Axia Ltd. 34
Victor Products (Wallsend) Ltd. 19
Volex Electrical Products Ltd. 73

Wades (Halifax) Ltd. 48
Wandleside Cable Works Ltd. 53
West Insulating Co. Ltd. 60
Westinghouse Brake & Signal Co. Ltd. 13
Wootton & Co. Ltd. 19

Yorkshire Switchgear & Eng. Co. Ltd. 7

Advertisement copy and blocks for printing in black and white should reach us 16 days preceding date of issue addressed to Electrical Review, Dorset House, Stamford Street, London, S.E.1

ADVERTISEMENT BLOCKS

Will advertisers on whose behalf we still hold blocks last used between 6th January, 1956 and 28th December, 1956 please advise us by the 31st January, 1959 if they wish them to be returned

Unwanted blocks will be destroyed

TRADE TUNION MARK

WALL BRACKETS

We offer you a wide selection of artistic plastic wall brackets designed to fully meet the present-day requirements for home furnishing and for commercial premises.

TMB/161

TMB/161. This E.S. Type is available either with or without pull switch and can also be supplied for exposed lamp.

TMB/158. This B.C. type takes a standard shade with 1¼" hole. It can be supplied with or without pull switch and also for inverted lamp to face upwards.

TMB/158

The above types can be supplied in BROWN. Both types available BC and ES.

Further types of wall brackets are detailed on page 20 of our 34 page illustrated Brochure 1453/ER and you are invited to apply for a copy. The Brochure also gives information of over 400 Tunion products.

GEORGE TURNOCK LTD

Tunion Works, Navigation Street, WALSALL, Staffs

Telephone: Walsall 4966

NEW! THE GODWIN

MICRO FLOAT SWITCH

A.C. – 10 AMPS – 500 VOLTS SINGLE POLE

- For automatic control of pumps of any make.
- Weatherproof aluminium case.
- Instantaneous make and break.
- Nett weight 3¾ lbs.
- Packed in carton.
- Write for leaflet.

RETAIL **54/6**

H. J. GODWIN LTD.

QUENINGTON · GLOUCESTERSHIRE · ENGLAND

Tel: Coln St. Aldwyns 271 (6 lines)

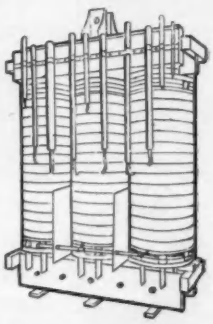
TRANSFORMER REPAIRS & REWINDS

10—3,500 kVA

Efficient Service at Competitive Prices

ESTIMATES FREE

All Work Guaranteed



OLDFIELD ELECTRICAL REPAIRS

Oldfield Works, Atlantic Street

Broadheath, Altrincham, Cheshire

Phone: Altrincham 2774-5

WINDMILL LANE ESTATE
DENTON

ELECTRICAL CONTRACTORS
Plant Electrical Installations,
Hyde, Cheshire.

BUILDERS
Bentley Building Co. Ltd.
Oldham, Lancs.

ELECTRICAL INSTALLATIONS:

Volex

CABLES USED THROUGHOUT

VOLEX makes the point...

.....in fact VOLEX CABLES make no less than 1800 Lighting points and 1000 Socket points on this new housing estate.

The Windmill Lane estate at Denton, Lancs., is only one of the many housing sites where Volex Cables have been installed throughout.

Due to their proved qualities of endurance and complete reliability, more and more electrical contractors are using Volex Cables exclusively in building projects throughout the country.

"VOLEX" CABLES INCLUDE

- **VIR** Taped, Braided and Compounded. To B.S.S. 7, 1953, Table 22, Amendment 3.
- **TRS** To B.S.S. 7, 1953, Table 26, Amendment 3.
- **PIPVC** Polythene insulated PVC sheathed. To B.S.S. No. 1557 - 1954.
- **PVC** Insulated. To B.S.S. No. 2004-1955 Table 14.

VOLEX ELECTRICAL PRODUCTS LTD.

Telephone : PENDLETON 4373. SALFORD 6. Telegrams : VOLEXPROD. Salford 6.

Ask your Wholesaler for

"ARMORDUCT" CABLES

Always the Best

They comply in every respect with dimensions and tests laid down in the Amendments of the latest B.S.I. Specifications, and are manufactured throughout in our Factories at Long Eaton and Dorking

ARMORDUCT CABLE CO. LTD.
1-3 Brixton Road, LONDON, S.W.9. Factories: Long Eaton and Dorking
Telephone: RELliance 7044 (3 lines) Telegrams: Armorduct, London, S.W.9 ABC Code (5th Edition)

THERMAL ELEMENTS

- CERAMICS
- INSULATORS
- INDUSTRIAL ELEMENTS
- TERMINAL BLOCKS
- DOMESTIC ELEMENTS

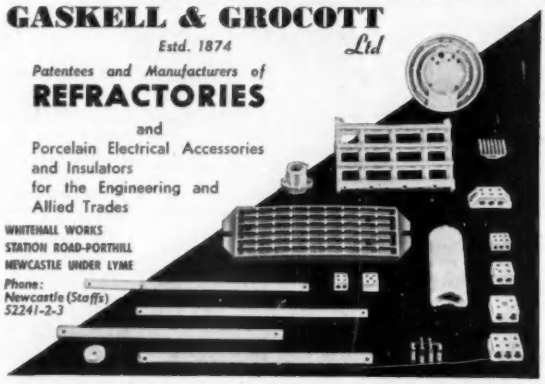
STATION WORKS
WHYTELEAFE, SURREY
Telephone: Uplands 5285

THE PERFECT FAULT FINDER
"NEO-MAINTEST"

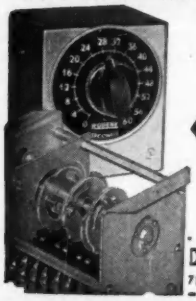
POTENTIAL INDICATORS MADE TO MEET USERS' REQUIREMENTS

NEO ELECTRICAL INDUSTRIES LTD.
MANCHESTER 4

GASKELL & GROCOTT *Ltd*
Estd. 1874
Patentees and Manufacturers of
REFRACTORIES
and
Porcelain Electrical Accessories and Insulators for the Engineering and Allied Trades
WHITEHALL WORKS
STATION ROAD-PORTHILL
NEWCASTLE UNDER LYME
Phone: Newcastle (Staffs) 52241-2-3



RODENE TIMERS
FOR MOST AUTOMATIC CONTROL NEEDS!



The "Rodene" high torque instant start, synchronous Timer-Motor with built-in automatic clutch.

Self-reset and Multi-cam Timers.

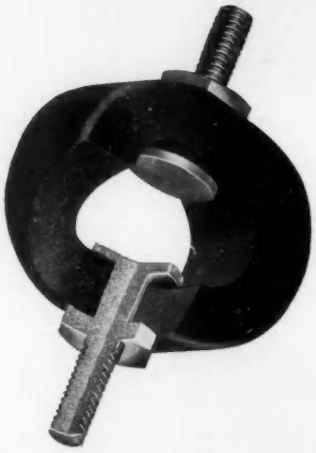
Made in England.
SEND FOR LIST R.I.

D. ROBINSON & CO. Tel: Hounslow 6266/7
717 LONDON ROAD, HOUNSLOW, MIDDX.

Published by ELECTRICAL REVIEW PUBLICATIONS LTD., at Dorset House, Stamford Street, London, S.E.1
and printed in Great Britain at THE CHAPEL RIVER PRESS, Andover, Hants.

Photograph of the Viscount by courtesy of Messrs. Vickers-Armstrongs (Aircraft) Limited.

quietly doing a job —



One of the most versatile of Silentbloc anti-vibration mountings is the Ring-Stud type. This type was used for mounting the very sensitive relays in the generator power circuit positioned on the power panel under the cabin floor of the Vickers Viscount. The cut-away illustration shows the unique construction of the Silentbloc Ring-Stud type mounting which has the merit of not being dependent on bonding, the rubber and studs being mechanically locked. This is only one of hundreds of Silentbloc anti-vibration mountings. Whatever your vibration problem Silentbloc will have the answer.

SILENTBLOC

SILENTBLOC LIMITED, MANOR ROYAL, CRAWLEY, SUSSEX

Telephone: Crawley 2100 (4 lines) Telegrams: Silentbloc, Crawley

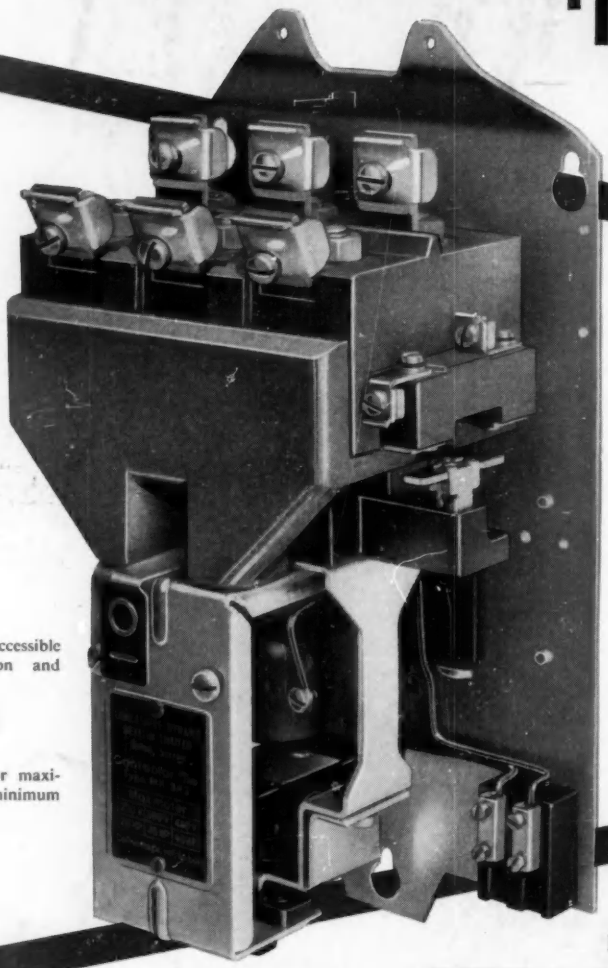
LDN Contactors and Contactor Starters 'Type MK'

★ Complies with relevant British Standard Specification (frequent duty).

★ Modern design gives robust yet simple construction combining reliability in service with exceptionally long operating life.

★ All parts readily accessible for easy installation and inspection.

★ Silvered contacts for maximum life and minimum maintenance.



MK3 Contactor

★ Clamp type solderless terminals for rapid connection.

★ Contact carriers moulded from arc resistant, non-hygroscopic material with internal phase barriers.

★ Complete range of thermal overload units available.

★ Can be supplied as shown or fitted in wall mounting steel or cast cases.

MK Contactors
are available from stock in 15, 25, 60 and 100 ampere ratings for a.c.

Control Coils
can be supplied for a wide range of a.c. and d.c. voltages.

Auxiliary Contacts
can be fitted to all sizes of contactors.

For long and trouble-free operation specify L.D.N. Contactors.

Write for
Technical Leaflet
LS 2510

LANCASHIRE DYNAMO NEVELIN LTD

(SWITCHGEAR DIVISION)

HURST GREEN, OXTED, SURREY. Telephone: OXTED 3361. Telegrams: NEVELIN OXTED

A MEMBER OF THE LANCASHIRE DYNAMO GROUP

S.5